DOCUMENT RESUME

ED 175 078 EA 011 573

AUTHOR	Radnor, Michael; Hofler, Durward
TITLE	Policy Studies in Research, Development and Innovation. Part One.
INSTITUTION	Northwestern Univ., Evanston, Ill. Center for the Interdisciplinary Study of Science and Technology.
SPONS AGENCY	National Inst. of Education (DHEW), Washington, D.C.
PUB DATE	Dec 77
NOTE	460p.; For related documents, see EA 011 570-574
EDRS PRICE	MF01/PC19 Plus Postage.
DESCRIPTORS	Agency Role; Comparative Analysis; *Educational Research; Evaluation; Information Dissemination; Information Utilization; Innovation; *Policy Formation; *Research; Research Needs; Research Problems; Research Utilization; Systems Analysis
IDENTIFIERS	*National Institute of Education; *Policy Analysis; Research and Development; *Research Development and Innovation

ABSTRACT

Part 1 of a two-part series, this volume presents three separate policy studies done using a contextual research, development, and innovation (RD & I) analysis framework developed by the authors. The studies are intended to demonstrate the requirements and possibilities for policy analysis in the RD & I arena and the utility of the framework for facilitating such endeavors and for providing structure to the knowledge and literature in this field. The first policy analysis, done for the National Institute of Education (NIE), looks at research, development, dissemination, and evaluation research in the field of education and suggests implications for the role of NIE. The second policy analysis provides a systems analysis of educational RD & I evaluating the current state of the system. The third policy analysis discusses and points out deficiencies in two reports. The first report is one done by the National Academy of Sciences (NAS) concerning fundamental research relevant to education and written to help the NIE fulfill its responsibility in this area. The second report analyzed is a response to the NAS report done by the Program Committee of the National Council on Educational Research. This report also contains a series of policy recommendations for NIE. Copies of both reports are included in the appendix. (Author/JM)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

ED175078

CENTER FOR THE
INTERDISCIPLINARY STUDY
OF SCIENCE AND TECHNOLOGY

Northwestern University
Evanston, Illinois

Policy Studies In Research, Development And Innovation

Part One

December 1977

1851

Michael Radnor
Durward Hofler

EA 011 573

TABLE OF CONTENTS

PART ONE

Introduction

Chapter One

Agency/Field Relationships in the Educational R/D&I System:
A Policy Analysis for the National Institute of Education
Michael Radnor
Harriet Spivak
Durward Hofler
and Earl C. Young

Chapter Two

Assessment of Educational R/D&I
Michael Radnor
Durward Hofler
Harriet Spivak

Chapter Three

Strengthening Fundamental Research Relevant to Education:
A Discussion of the Reports of the National Academy of Sciences
and the NCER Program Committee
Michael Radnor
Durward Hofler
Harriet Spivak

PART TWO

Chapter Four

Regionalism in Educational R/D&I: A Policy Analysis for the
National Institute of Education
Durward Hofler
Michael Radnor
Harriet Spivak

Chapter Five

A Contextual Approach to Program Planning: An Introduction

Michael Keeley
Michael Radnor
Durward Hofler

Chapter Six

R&D Coordination in the Social Science Context

Durward Hofler
Michael Radnor

Chapter Seven

Analysis, Selection and Planning of Programs and Projects by the Division of Industrial Energy Conservation of the Energy R&D Administration Phase One Report

Michael Radnor
Andrew Bajkowski
Eliezer Geisler
William Hetzner
Durward Hofler
Paul Lerner
James Schrager
Earl Young and
Robert Howard
Michael Keeley
Andrew Weiss
Elizabeth Olmsted

Chapter Eight

Contextual Approach to Development and the Role of Techology in Developing Countries

Atul Wad
Michael Radnor
Durward Hofler
Maryann Joseph

Chapter Nine

Postscript

We want to express our appreciation to the many people who made helpful comments and suggestions during the preparation of this volume. In particular, we are grateful for the contributions of Ward Mason and John Williamson.

We wish to acknowledge the invaluable assistance provided by our administrative assistant, Elizabeth N. Olmsted, whose help enabled us to prepare this report at this time.

INTRODUCTION

CONTENTS

Page

I. POLICY MAKING: DIFFICULT YET IMPORTANT 5

II. POLICY SCIENCE: INSIGHTS INTO THE PROCESS OF POLICY ANALYSIS 7

III. THE CHALLENGE OF R/D&I POLICY ANALYSIS 10

IV. A FRAMEWORK FOR CONTEXTUAL ANALYSIS OF R/D&I 12

- 1. The Perspective of General Systems Theory 13
  - A. Extent of R/D&I System Linkage 14
  - B. Maturation (State of Development) 14
  - C. R/D&I System Variations and Commonalities 15
- 2. A Framework for "Mid-Level Analysis" 18
- 3. A Contextual Framework: Describing R/D&I Systems in Terms of Their Interactive Features 19

V. EIGHT CONTEXTUAL R/D&I POLICY ANALYSES: A "COLLECTIVE" OVERVIEW 23

- 1. History and Context 23
- 2. A Growing Understanding of Contexts and Issues 24
- 3. Some Further Observations about Contextual R/D&I Policy Analysis 26

VI. EIGHT CONTEXTUAL R/D&I POLICY ANALYSES BRIEF PREVIEWS 30

- 1. Agency/Field Relationships in the Educational R/D&I System October 1976 30
- 2. Assessment of Educational R/D&I December 1976 32
- 3. Strengthening Fundamental Research Relevant to Education August 1977 34

CONTENTS (Continued)

Page

4. Regionalism in the Educational R/D&I Context December 1977 36
5. A Contextual Approach to Program Planning September 1977 37
6. R&D Coordination in the Social Science Context November 1977 38
7. Analysis, Selection and Planning of Programs and Projects by the Division of Industrial Energy Conservation of the Energy R&D Administration: Phase One Report September 1977 39
8. A Contextual Approach to Development and the Role of Technology in Developing Countries September 1977 41

FIGURES

Figure 1 -- Comparative R/D&I System Features

This volume addresses itself to a difficult and complex set of issues related to the making and implementing of policies with respect to Research, Development and Innovation (R/D&I)* processes and systems. Despite the existence of large (if fragmented) literatures on policy and R/D&I relevant subjects, the complexity of R/D&I and policy making issues and processes continues to confound policy makers. Never easy, policy making in the R/D&I context can be especially perplexing for the policy maker, the manager and the analyst. Not the least among the factors causing this condition is the uncertainty associated with such processes. This uncertainty is manifested in goal setting (we generally lack precise targets; goals are frequently emergent); in resource requirements (it is usually very difficult to estimate the how much, what kind and how long parameters of what it will take to pursue a project or program); and consequently, in evaluation efforts and cost/benefit considerations (it is often difficult to obtain agreement as to what benefits are relevant; to measure and evaluate the impact of programs or projects; or to assign and measure costs). Because we are dealing in futures (often quite long-term), the process is subject to numerous and potentially dramatic consequences of changes in the environment (social, political, technological, ecological, etc.) in which the work goes on; thus, forecasting becomes an important yet difficult aspect of policy. Because we are dealing with innovation, issues of response to change and the complexity of knowledge processes come into play.

---

*The meaning of the concept of R/D&I is discussed later in this introduction.

The sources and locations of the innovation process (and its components) are of major policy concern. Is the process to be driven by technological opportunity or by user need (often described in push/pull terms)? Who is/should be involved in the process? What is the nature of the actual and/or needed interaction between producers and users? What is the impact of such interaction (or the lack of interaction)? Requirements for dealing with dissemination, implementation and diffusion of innovations thus become a part of policy concerns. How do these producer/user and push/pull issues vary as a consequence of the nature of the field, the nature of the knowledge base and the maturity of the R/D&I system and its institutions. The various components of an R/D&I process (the research, the development, the dissemination, etc.) tend to have substantially different characteristics and policy and management requirements; thus, there arise issues of linkage and balance between and across these R/D&I process components. The above are not well understood phenomena, and they make policy making difficult.

Such issues arise at the institutional level (generally thought of in terms of R&D management in business and governmental organizations), and at system sectoral, national and even international levels. Thus, inter-organizational issues arise such as those involved in the R/D&I systems in education, in law enforcement, in an industry, in energy, with respect to the role of technology development for the third world, etc. In such cases, the complexity of the policy issues is increased immeasurably.

Finally, we may note that we are dealing with policy questions that will involve professionals and professional organizations. Policies and management procedures that ignore the implications of this fact in terms of goal setting, decision processes, motivational patterns, information flows, reference groups etc., are doomed to fail.

In this volume we will deal with several such policy issues, using a contextual analysis framework that we have developed. This framework reflects a synthesis of the research and policy literatures on R&D management, the economics of R&D, innovation, the sociology of science, the management and policy sciences, and of many years of managerial and research experience with such questions. A brief description of this framework is given below. For a more complete description the reader should turn to a companion volume* (Research, Development and Innovation: Contextual Analysis 1977).

The policy issues we have dealt with and which are presented and analysed in subsequent chapters of this book were for the most part presented to us as major R/D&I concerns for the organizations involved. We had little or nothing to say in defining the initial problem statement, although we had much to say in terms of redefining the problems for analysis into forms that had useful and policy actionable implications. We then went on to use our analytical framework to develop the policy and managements requirements in each case. It is our hope that in presenting these, we can demonstrate both the requirements and possibilities for policy analysis in the R/D&I arena, and the utility of our framework for facilitating such endeavors and for providing some structure to our scattered knowledge (and literatures) in this field. Further, we believe that this framework makes an important contribution to dealing with the problems of comparative policy analysis across fields and sectors by showing how one can and must deal with contextual differences, and therefore by implication, with the consequences for attempts to transfer experience and methods from one sector to another (e.g.: as between industry and education and aerospace, etc.). Comparative analysis of policy issues also illustrates differences between R/D&I in social science contexts and R/D&I in physical or life science contexts as well as between specific sectors. These differences can also be critical in attempts to transfer experience and methods across sectors. These last points are elaborated in some detail in the previously cited comparison volume.

---

*Three volumes have been prepared to illustrate the nature and utilization of our contextual analysis framework. Each is directed to one of three specific audiences: (1) policy analysts and policy makers; (2) researchers; and (3) the educational R/D&I community.

Before going further, let us consider some of the more general issues of policy making and then return to the specific arena for this book, policy making in Research, Development and Innovation.

I. POLICY MAKING: DIFFICULT YET IMPORTANT

The making of policies is at best (as we have noted) a difficult business. In any given instance, a policy maker is faced with such critical issues as:

- the sufficiency, adequacy, availability of needed information;
- choices among alternative policies, each of which will likely have different (and perhaps conflicting) ramifications; is likely to have critical limitations; will likely involve a set of assumptions about conditions which must and/or do exist, the expected impact of the policy; the "values"/goals/purposes which the policy is to serve, etc.;
- the resources required to implement a policy;
- a variety of uncertainties such as the uncertainties of economic, political and socio-cultural realities and dynamics; the uncertainties asspciated with diffuse and loosely linked systems (as in the social science context); the lack of clarity and consensus over goals at the level of national systems and of large complex organizations; etc.;
- identifying, comprehending and "sorting out" the broad, interactive complex of factors and dynamics which may be relevant for any given policy issue;
- the potential interactive effects among a variety of policies within a single institution or between a set of institutions which may be loosely linked (if at all) and whose interests and purposes (and hence policies) may at times be either conflicting or complementary;

- constraints which must, in effect, be accepted as "givens".

Policy making, then, is not an easy task. The complexities and uncertainties tend to be of large magnitudes. Relevant conditions change over time -- sometimes in a very brief period of time. Variables are often non-quantifiable (except perhaps in a very indirect, "indicator" sense). The policy maker, as a human being, brings to the policy making task particular assumptions, biases, views of "reality", values, goals, etc. (and those may be personal, organizational and/or cultural in nature). The policy maker will generally be provided (or confronted) with "partisan" information, advice, perspectives (Cain 1971) -- and will similarly be faced with various "power" realities (e.g.: political power that the Congress has over the funding -- and even the existence -- of a federal agency).

While policy making is not an easy task, it is nonetheless an important task. Cain describes policies as "discrete, particular, authorative, content-laden decisions which indeed come out of some process and presumably have critical ramifications for somebody, and often everybody." While arguing that the complexity may be such that analysis can never be "good enough" to "solve" a policy problem, Lindblom (1968) also argues that policy analysis does have an impact -- and more so the better it is done. And we may simply note that the absence of a policy also has ramifications and impact.

II. POLICY SCIENCE: INSIGHTS INTO THE PROCESS OF POLICY ANALYSIS

In light of the importance yet difficulty of the policy making process, it is little wonder that over the past decade or so, a field of policy science has been developing -- in effect, as an "effort to cope with the needs of a complex, dynamic and demanding society" (George Washington University, 1968-1969). This field has not yet matured and thus does not yet have a well-defined identity or image (Lasswell 1970) -- indeed, Radnor, White and Tansik have offered several "definitions" of policy science (or aspects of policy science): a process for handling complex policy issues by including consideration of "political, institutional, 'irrational' (but real), and other nonquantifiable and value-laden factors"; a descriptive study; improvement in the design of the policy-making process; a set of skills, people, etc.; and just "something responsive to ill-structured complexity" (Radnor, White and Tansik 1975). We may draw some significant insights into the nature of policy analysis from this developing field of policy science.

1. Complex issues must be examined in the light of their total, complex, interactive contexts. Complex issues simply cannot be "effectively dealt with in a partial, specialized and arbitrary manner" (George Washington University 1968-1969). The implication here is two-fold:

   a) Policy analyses must consider a broad range of dynamics, factors, contextual conditions, etc.

   b) The context for a policy issue must be analysed from multiple perspectives (e.g.: the perspectives of various disciplines and professions; the perspectives of those who make, those who must implement and those who would be impacted by a policy; the perspectives of varying, multiple purposes which might be relevant to a policy; etc.)

In a word, the context used as a basis for analysis must be "sufficiently comprehensive to identify significant relationships" (George Washington University 1968-1969).

2. At the same time, policy analysis must be "sufficiently limited to be managed effectively" (George Washington University 1968-1969), and to be useable for the policy maker -- i.e., policy analysis must be focused.

3. The function of policy analysis is to provide a "handle" that enables a policy maker to "take hold" of a policy issue -- i.e., policy analysis "must provide decision-makers with a basis for more confident control over events by assisting in the articulation of critical contingencies," (George Washington University 1968-1969) conditions, dynamics, factors, opportunities, constraints, etc.

4. Policy analysis may be seen as a process for identifying and analyzing alternatives (George Washington University 1968-1969): alternative descriptions of the context of a policy issue; alternative goals and objectives; alternative ways of conceptualizing an issue; alternative courses of actions; alternative predictions of probable outcomes of certain courses of action are taken; alternative methods for measuring, obtaining data about and evaluating policy outcomes; etc.

5. Care must be taken to recognize the limitations of policy analysis in general and of specific policy analyses. For example: the policy analyst will tend to bring certain personal, organizational and/or socio-cultural assumptions and perspectives to the task of analysis. The "givens" of a society may significantly pre-determine the shape of a policy (George Washington University

1968-1969). Policy analysis may be validly seen as an attempt to bring "rationality" to bear on a policy issue -- yet "rationality" is limited by the complexity involved, by the non-quantifiable and value-laden nature of policy issues, by lack of information, by political considerations,[*] a lack of well-defined goals, and even by the very meaning of rationality" (Dror, 1975).[**] Lindblom argues, in effect, that policy making is and will be an imperfect process: "man's design of the (policy making) system never controls specifically or precisely -- but only within broad limits . . ."[***]

---

[*] The impact of political considerations may call for a "different" kind of rationality than we normally mean when we speak of "being rationale".

[**] Dror comments that the term "rationality" is used either "as a synonym for 'reasonable', or as referring to estimation ability, or as referring to operations-research-like capability or -- usually -- as referring to a mixture of all these possible meanings."

[***] Lindblom notes a distinction between "good analysis" and "partisan nature of analysis" views of the nature and process of policy analysis.

III. THE CHALLENGE OF R/D&I POLICY ANALYSIS

Thus far, we have talked about policy analysis and the policy process from a general level perspective - - i.e., at the "generic" level. Our concern in this volume, however, is as we stated earlier, somewhat more specific. We are here concerned with policy analysis relevant to Research, Development and Innovation (R/D&I).

The use of the term "R/D&I" is deliberate. One of the major weaknesses in R/D&I policy making has been that "R&D" -- the production of new knowledge (KP) and knowledge products -- is given an essentially exclusive and myopic emphasis. Inadequate consideration tends to be given (by those concerned with R&D systems and policy issues) to the fact that R&D is only a part of a more total process of innovation -- a process which includes not only the knowledge production functions of research and development but "downstream" knowledge utilization (KU) functions of acquisition, implementation, utilization -- as well as KP-KU linking functions such as need identification, dissemination/diffusion/marketing/distribution, and evaluation research. Thus, to connote this total process of innovation of which R&D is a part, we use the term R/D&I -- Research, Development and Innovation.

Another major problem that has tended to plague R/D&I policy analysis and policy making has been an inability to deal with contextual complexity on the one hand and, relatedly, the complex interplay of R/D&I issues on the other hand. Thus, we tend to find that policy analysis flounders at either of two extremes. At one extreme, R/D&I policy issues have been approached from the particularistic perspectives of specific theories, specific disciplines, specific institutional perspectives -- perspectives which are too specific to comprehend the complexity involved in a policy issue and which thus can neither identify the range of relevant variables and alternatives nor "sort out" the most critical variables and alternatives. At the other extreme, policy issues have been approached from a "total world" perspective which attempts to cover everything and leave out nothing -- with the predictable result that policy analysis gets bogged down in a complex morass of issues, factors, dynamics, details, alternatives, contingencies, etc. The policy maker is then left with a certainty that there exists a very big problem -- but with little else. The policy maker has no "handles", no indication of which factors are most critical, which factors can be impacted, or what particular policies and strategies are relevant or feasible.

Similar comments can be made in relation to R/D&I program and project selection processes. "Downstream" utilization issues tend to be ignored. Significant variances are often ignored because assumptions are made that certain factors will remain constant, when in fact such assumptions may be quite in error.

Thus, the need in R/D&I policy analysis is for some process or mechanism which allows the policy analyst to consider the total process of innovation; to identify and take into account the interplays among policies and policies issues, between institutions, etc.; to consider a broad range of contextual conditions and variables (e.g., institutional, personnel and knowledge/technology bases; political, legal, economic, social environments; information flows; historical development issues; etc.); -- and at the same time to focus analysis on those considerations which are most critical for the policy issue at hand.

IV. A FRAMEWORK FOR CONTEXTUAL ANALYSIS OF R/D&I*

Without trying to debate whether any policy analysis can ever be "completely rational" or "completely comprehensive" (though we have our doubts), we do believe that the policy analyst must have some analytical framework which allows the analyst to take into consideration the full, broad range of contextual complexity and then to identify those factors which are most critical in order to limit and focus the analysis. Such a framework must be able to take into consideration, separately and in interaction, those factors and dynamics which are generic to R/D&I and those which are (descriptively) specific or peculiar to the particular R/D&I system and/or issue at hand. Such a framework must be able to utilize varying perspectives and to be utilized by personnel having differing perspectives.

Over the past two years, the Northwestern University Center for the Interdisciplinary Study of Science and Technology (CISST) has been attempting to develop such a framework -- which we call a "contextual analysis framework" -- and it is the purpose of this report both to describe this framework and to illustrate its usage in policy-relevant ways.

Before turning to a discussion of this contextual analysis framework, it is critical that it be recognized for what it is -- and what it is not. A contextual analysis framework is a tool for analysis -- specifically, it provides a means of access into analysis which allows the analysis to be comprehensive, yet focused. It is not a substitute for analysis, or for knowledge about the subject matter at hand; nor does it guarantee the validity, efficacy or relevancy of a policy analysis.

---

*A more complete discussion of this framework is found in, Radnor, Michael, Harriet Spivak and Durward Hofler, "Research, Development and Innovation: Contextual Analysis", December 1977.

The nature and adequacy of policy analysis remains the domain of the policy analyst -- just as policy decisions remain the domain of the policy maker.*

1. The Perspective of General Systems Theory

The framework presented here for the analysis of R/D&I systems has been drawn from the general systems theory literature. Without attempting to present an exposition of this perspective, we simply note that we have adopted the central elements of their framework for describing the structure and functioning of living systems.

Thus, we will attempt to analyze R/D&I systems in terms of how they interact with their environments; their central elements or sub-systems; the mechanismsthat link them together; internal system structures; input-output systems as well as such other system conditions as age and state of developmental maturity.

An important question is that of system definition: What is to be considered within the R/D&I system (and within which part of the system) and what is in the environment? The framework we are presenting does not contain abrupt boundary notions. What is considered within or external to the system and whether an R/D&I system is defined broadly (as a whole sector) or narrowly (as a single institution) is a matter of degree and will depend upon the focus and purpose of analysis. Thus, rather than being limited by a rigid conceptualization about boundaries and sizes, the definition of the relevant R/D&I systems (as is true of all other aspects of the analytical framework) is based on creating an opportunity to frame key questions related to the focus of the issue analyses relevant to policy/decision makers, and researchers.

---

[*] The discussion which follows is derived, with slight modification from Radnor, Spivak and Hofler, 1977.

Two aspects of a systems perspective on R/D&I are worth noting here.

A. Extent of R/D&I System Linkage

One aspect of the "system" concept that should be considered here is the extent to which the various institutions within an R/D&I system are (or are not) coherently and strongly linked together. Simply put, while we do consider a set of institutions to comprise an R/D&I system (because of the roles they play within the total process of innovation), we do not presume that they are in fact coherently linked together in "appropriate" ways or that existing linkages are strong. Indeed, the opposite may be true in any given context -- and there may be "gaps" in the system's linkages. Indeed, the critical issues here are precisely the nature, strength and appropriateness of the linkages (or lack thereof) which do exist.

B. Maturation (State of Development)

It is important that we understand R/D&I systems from an "organic" perspective. That is to say, that they "emerge" over time, that they go through/may be at different stages or levels of development (maturation). Further, different institutions and/or different functions within an R/D&I system may differ in terms of their respective stages or levels of development. The importance of this concept of maturation may be seen in at least the following ways:

1. The needs of an R/D&I system may be different when the system is young and immature than when it is established and mature.

2. Since R/D&I systems may mature (or decline) over time, their needs may change over time.

3. Policies, strategies and mechanisms which are relevant for an R/D&I system which is young and immature may be irrelevant (even dysfunctional) for an R/D&I system which is established and mature.

4. Further, different policies/strategies/mechanisms may be needed when the R/D&I institutions and/or functions are at different stages of development than when their levels of development are "in balance".

We need, however, to understand that the concrete meaning of "maturation" may differ significantly across sectors. Thus, for example, even at a "mature" stage of development we would not expect to find the same level of clarity and certainty in the evaluation research function in a social science sector such as education as we would in a physical science sector. The realization of inherent differences between sectors will be important if we are to avoid making incorrect comparisons of (and developing the wrong expectations for) one R/D&I system in relation to other R/D&I systems.

C. R/D&I System Variations and Commonalities

In attempting to develop a contextual analysis framework for R/D&I systems, one is immediately struck by the immense amount of observable variety in real-world R/D&I systems. Existing R/D&I systems vary in such matters as: clusterings of functions within a single organization (or even within a single organizational unit); existence and strength of institutional networks; overall level of system maturity; susceptibility to political influence; types of dissemination mechanisms and strategies; use and effectiveness of various management technologies; etc.

R/D&I systems vary across sectors. Thus, for example, the R/D&I system in aerospace differs significantly from the R/D&I system in education. But the issues are complicated even further because R/D&I systems also vary within a single sector. Thus, for example, within the private industrial world we encounter rather different R/D&I systems for the oil and T.V. industries. In health, the R/D&I system for drugs and surgical procedures will vary.

In spite of the immense amount of observable variety among existing R/D&I systems, these systems nonetheless do also seem to exhibit common characteristics -- characteristics that imply the existence of generic features of R/D&I systems.

From a broad, overview perspective, we may note that all R/D&I systems involve some rather basic, common functions, such as research, development, production, dissemination, utilization, etc. The specific form, manner or configuration of these functions may vary across sectors, but the functions themselves appear to be inherent in the overall innovation process of an R/D&I system.

We may further note that for any single R/D&I function, there appear to be characteristics which are common (i.e., generic) to that function both across and within sectors. For example, the basic research function involves a high level of uncertainty and unpredictability; involves extending the limits of the existing state of the art (a criteria for "excellence" in basic research); often involves a long time-line (10, 20, even 50 years). These characteristics, if indeed generic, will have strong implications for policy making and management in R/D&I systems.

In contrast, the function of development involves a significantly lower degree of uncertainty and unpredictability; is concerned with utility and "product specifications" instead of "ultimate" qualities; requires less highly specialized and more interdisciplinary personnel; and generally tends to have a short to moderate time-line (usually at least 3 to 5 years, sometimes longer). These characteristics, if indeed generic, will have strong implications for policy making and management in R/D&I systems -- but the implications will be significantly different from the implications relevant to basic research. Further, these differences between the basic research and development functions (and other functions as well) will have strong policy making/management implications concerning the integration/coordination/orchestration of the various R/D&I system functions.

It is also important to note that a "real-world" R/D&I system emerges as an interactive "working out" of generic R/D&I characteristics within a specific sectoral context -- whether by deliberate design or not.

Thus, both the researcher and the decision maker must understand that R/D&I system features, issues and management policies/strategies will have both generic and sectoral dimensions, and that these will all be in interaction with each other.

For the decision maker, the importance of understanding this "emergent" nature of R/D&I systems is threefold.

1. An understanding of the generic characteristics of R/D&I systems enables the decision maker to "zero in" on the areas of the sectoral context where the critical issues are likely to be and where in-depth analysis of the sectoral context is needed.

2. An understanding of the nature and uniqueness of one's sectoral context provides a basis for learning from R/D&I systems in other sectors and for determining the adaptability/transferability of knowledge, methods,

techniques, innovations, etc., from R/D&I systems in other sectors.

3. From an understanding of the interaction between generic and sectoral characteristics, the decision maker has a basis for developing policies and strategies which are both generically functional and sector-specific.

2. A Framework for "Mid-Level Analysis"

Our contextual analysis framework serves to focus attention on a somewhat neglected area of research and analysis, sometimes referred to as "mid-level" or "mid-range". As used here, this "mid-level" refers to research and analysis which is somewhere between the broad level of general theory and the narrow level of specific cases.

At the general theory level, the purpose of research and analysis is to develop concepts and relationships which serve to describe all situations (i.e., theories). The approach at this level is to develop processes of research and analysis which will uncover the broadly generalizable concepts and relationships. While important, general level theory lacks the specificity which is needed by policy and decision makers.

At the specific case level, the purpose of research and analysis is to discover and demonstrate the uniqueness of each situation, and the approach to research and analysis is designed specifically to uncover such uniqueness. At this level, research and analysis tends to lack bases for generalizability. Thus, this level of research and analysis also has limited value for policy and decision makers.

Our contextual analysis framework utilizes a disciplined configurative approach that will permit systematic comparison of various sectors or policy/strategy issues. The purpose is to develop appropriate areas of generalizability which allow one to take into account the uniqueness of specific situations.

3. A Contextual Framework: Describing R/D&I Systems in Terms of Their Interactive Features

In developing a framework for contextual analysis, we have identified nineteen key R/D&I system features which we believe will be helpful both to the researcher and to policy analysts and to policy makers. (see Figure 1). For simplicity of presentation, we have grouped these nineteen features into the following categorical framework (using a general systems theory approach):

1. The R/D&I System's Environment

   This category will include those features which are external to the R/D&I system itself, but which may nonetheless impinge upon and affect the system -- and, alternatively, which the R/D&I system may affect (e.g.: social, legal, political, economic, technological environments).

2. Operative System Conditions

   This category will include features internal to the R/D&I system which affect the way the system operates but which are not activities by which the system creates or utilizes knowledge. These features will thus include general system conditions (e.g.: historical development), aspects of system management (e.g.: administrative processes) and system inputs and outputs (e.g.: personnel base).

3. R/D&I Functions

   This category will include those features which we would consider to be an integral part of a knowledge production to knowledge utilization process continuum -- i.e., what the system does to create and utilize knowledge.

Typical Comparative Features

I. ENVIRONMENT	1. Environments of the R/D&I System
II. OPERATIVE SYSTEM CONDITIONS	
SYSTEM	2. Historical Development
	3. Institutional Base (Network of Institutions)
SYSTEM MANAGEMENT	4. Goals, Policies, Strategies
	5. Administrative Processes
SYSTEM INPUTS AND OUTPUTS	6. Personnel Base
	7. Funding
	8. Information Flow
	9. Innovations
III. R/D&I FUNCTIONS	10. Need Identification
	11. Generation/Research
	12. Development
	13. Production
	14. Marketing/Distribution/Dissemination/Diffusion
	15. Acquisition
	16. Implementation and Utilization
	17. Support Services
	18. Evaluation Research
IV. R/D&I RESEARCH	19. Research on R/D&I

Figure 1

Comparative R/D&I System Features

Additionally, we have included an overview feature: Research on R/D&I. This will include any kind of research done about any aspect of the system (any of the features or feature issues; any element of the system such as a particular institution or set of institutions; etc.). The results of such research, in effect, provide the data base for analysis of the other features.

Within each feature, a number of relevant issues may be identified. An expanded discussion of these nineteen key R/D&I features and illustrative issues associated with each feature is provided in Radnor, Spivak and Hofler (1977).

A different listing or arrangement of features and issues could, of course, be developed. What is important is to recognize, identify and analyze the potential or actual effects these various features may have (separately and/or in interaction) in the total R/D&I system.

4. The Context of an R/D&I System

Taken together, the totality of the R/D&I system features and issues forms an interactive context in which analysis and decision making must be performed. The way an R/D&I system has developed over time in its sectoral environment; the types of institutions that have emerged; the character of the work and technologies; the personnel involved in each of the functions and institutions; etc. -- all contribute interactively to the totality of an R/D&I system's context.

For example, how an R/D&I system is structured will be influenced by such factors as the social, political and economic environments of the institutions that constitute the R/D&I system; by the degree of system institutionalization; by the nature of the work to be performed; by the history and state of the system's development; by the nature of the system's personnel base; etc. But in turn, these same variables will also be influenced by the structure of the R/D&I

system. Such is the interactive nature of the R/D&I system context - each R/D&I system feature acts both as an independent variable (as part of the total system context, affecting the other parts of the system) and as a dependent variable (which may be a focal concern for analysis and decision making).

In any given instance, analysis or decision making will, of course, be focused on some subset of contextual features or issues (or even on a single feature or a single issue of a feature). Such a narrowing of focus is necessary to bring the analytical/decision processes down to manageable and meaningful levels. Indeed, it is important to recognize that each feature has important characteristics which do distinguish one feature from another -- differential characteristics which often have important implications for both analysis and decision making.

However, the consideration of any single feature (or issue) must take into account the interaction of that specific feature with all other features -- i.e., one must consider a single feature or issue within the richness of its total context. To try to analyze any single feature (or issue) without considering its contextual interaction would not only be inadequate -- it would likely be quite dysfunctional, leading to wrong conclusions by the analyst and to wrong decisions by the decision maker. Such is the interdependence within an interactive living system.

Therefore a context has to be understood as the intersection of the effects or influences of each of the system features. If we wish to understand the character and managerial requirements of a given feature or issue (e.g.: the personnel base) it will be necessary to view this feature against the background of all other elements or features of the system in its context. By the same token, if we are concerned with a sub-issue within the personnel base feature (e.g.: the flow rate of certain types of personnel in and out of the system), then we would also have to include all the other aspects of the personnel base feature (e.g.: the types and levels of professionalism) as part of the relevant context for that sub-issue.

V. EIGHT CONTEXTUAL R/D&I POLICY ANALYSES: A "COLLECTIVE" OVERVIEW

In the chapters which follow are presented eight policy analyses, each of which was prepared separately and stands alone in its own right. Before looking at them individually, however, it is important to understand what they represent collectively -- the history and context out of which they come; how doing them and interacting with our "clients" has affected our own thinking; what they represent as policy analyses; our use of certain terms.

1. History and Context

The contextual analysis framework discussed above and used in these policy analyses has been "in the process" of development over the past 2½ years -- though its roots may be traced back to our work over many years in the area we now call R/D&I. When the initial "rough draft" version of the framework was reviewed and discussed in a workshop of NIE, field and CISST personnel (Spring, 1976)* the response was essentially: "It sounds interesting, but would it really be usable and useful for policy analysis?" We agreed that this was a valid question -- one which could only be answered by actually demonstrating the use of the framework in specific policy analyses. We further agreed that for the demonstration to be valid, control over the selection of policy issues to be analyzed should not remain with CISST (like anyone else, we might tend to pick our "favorite" issues). Rather, the client agency should select those policy issues which would be most relevant to itself. Finally, we agreed that it would be important to demonstrate the applicability of the framework across a variety of sectors** -- as is represented in Chapters Six, Seven and Eight.

---

*The first presentation of the contextual analysis framework in published form is found in Radnor, Spivak, Young and Hofler (1977), which was an abridged version of the more recent volume on this subject (Radnor, Spivak and Hofler 1977).

**In this regard, a companion volume (Radnor, Spivak and Hofler, 1977) demonstrates the use of the framework to provide descriptive and comparative overviews of the contexts of four sectors: education, civilian aviation, health and criminal justice.

This collection of policy analyses, then, represents an illustration of the usability and usefulness of the contextual analysis framework in R/D&I policy analysis.

As the reader will note, each of the policy analyses uses the contextual analysis framework in somewhat different ways -- at least in terms of how its use has been "written up" in a particular analysis. Thus, only the coordination analysis (Chapter Six) specifically refers to all nineteen R/D&I features. By contrast, the analysis of fundamental research (Chapter Three) does not directly mention the contextual analysis framework even though it guides the arguments presented. Other analyses focus on a selected set of the nineteen R/D&I features (e.g.: agency/field relations: Chapter One; assessment of educational R/D&I: Chapter Two; regionalism: Chapter Four) -- while the ERDA analysis (Chapter Seven) combines the nineteen R/D&I features into a more compact set of R/D&I features which make the proposed process more usable in the context of building an operational decision makeup procedure.

These different ways of using the contextual analysis framework illustrate a critical point. The framework is a tool of analysis -- not a straightjacket. It can -- and indeed must -- be used in the way that is most fruitful for a specific policy issue or policy analyst. At the same time, we would be remiss if we did not emphasize that the perspective provided by the framework has permeated, directed and undergirded our work in each analysis -- regardless of how "visible" its use may appear in each analysis. We have indeed found this perspective to lead to insights which would likely have otherwise been missed -- by us and by the client agency.

2. A Growing Understanding of Contexts and Issues

The eight policy analyses presented here were developed at various times over the past eighteen months. During this time, we have found that our understanding of particular contexts and issues has both broadened and deepened -- and, in some instances, this had led us to modify some of our earlier thinking. In part, this has come through interactive discussion of an analysis with a client agency and with others in the field -- a process which we deliberately build into the development of a policy analysis. In part, this has come through interaction among the different policy analyses -- analyses which though separate and distinct nonetheless inform each other.

To illustrate, in the agency/field analysis (October, 1976) we suggested a need for a central core of educational basic researchers. Later, in the fundamental research analysis (August, 1977), we modified our discussion of this idea to recognize that some diffuseness in the field and lack of cumulativeness of research is natural in much of the social sciences.

Similarly, we have modified our understanding of what a "mature" R/D&I field would "look like" in the social sciences. Our discussion of a mature R/D&I system in the agency/field analysis* leaves the impression that all mature R/D&I systems would have clear-cut and finely-tuned lines of specialization, linkages, communication channels and networks; that it would be "easy" to distinguish between high quality and low quality R&D outcomes. Such a description of maturity may be relatively accurate for R/D&I systems in the physical sciences (though even here we would hesitate to be "too absolutely clear-cut"). However, we now recognize that R/D&I systems in the social sciences -- even in "mature" stages -- will probably always be more diffuse and it will be less easy to develop a clear descriptive "map" of linkages or clean-cut "standards" for "high" and "low" quality R&D products. This latter point would be especially true in the educational R/D&I context, where (often conflicting) value and political judgments cannot easily be "separated out" from an understanding of the meaning of "quality."

---

*Pages 209-210 of Chapter One in this volume.

In one sense, it would be tempting to have revised aspects of the eight policy analyses (to reflect our more recent understandings) before presenting them in this volume. To do so, however, would be to gloss over and deny important aspects of the policy analysis process -- namely, that policy analysis (as we noted earlier) is not and probably cannot be a "complete and precise science"; and that it is both proper and necessary that any policy analysis be considered subject to "improvement" through an interactive process of review and discussion. We have therefore deliberately chosen to present the eight policy analyses in the form in which they were initially presented to their respective client agencies.*

3. Some Further Observations about Contextual R/D&I Policy Analysis

This volume is about contextual R/D&I policy analysis. The chapters which follow demonstrate the use of contextual analysis in the R/D&I policy arena. This introduction has attempted to "set the stage" for reading the subsequent analyses by looking at the nature of policy analysis, of contextual analysis and of R/D&I.

A few final observations about contextual R/D&I policy analysis must now be made.

Each of the analyses which follow include some set of conclusions which we believe to be important for policy/decision makers. These conclusions represent a blend of deductive reasoning interacted with our own considerable experience in the R/D&I arena. This is precisely the way the contextual analysis framework is designed -- to allow an interactive process of deductive and inductive reasoning. We also recognize that alternative conclusions may sometimes be possible. This, too, is as it must be. Policy analysis simply is not a "precise science." Further yet, we do not consider either any individual analysis in this volume or the volume as a whole to be the "final word" or a "finished product." More examples and scenarios are needed. Related issues need to be explored. "Missing" data needs to be collected. Conclusions need to be reviewed and tested. These areas represent future challenges -- both to us and to the reader.

---

*Chapter Six (on social science R&D coordination) and Chapter Eight (on development and the role of technology in developing countries) represent partial exceptions -- i.e., the form of these analyses as presented here is somewhat different from the original analyses. In both cases, however, the analyses represent only a change of format -- and not of content -- from the original analyses.

It will also be important for the reader to recognize that the role of policy analysis is to help the policy/decision maker identify critical issues, ask the right questions, discover "blind spots," and avoid "dumb pitfalls." It is at this point that a contextual analysis framework comes into play -- by forcing consideration of the total R/D&I context while at the same time permitting one to identify and focus attention on the most critical areas for analysis and decision.

It is equally important to recognize that while a policy analysis may provide a basis for decision, it cannot take the final leap to decision, implementation, practice. This remains the domain of the policy/decision maker.

Finally, it will be helpful to call attention to the meanings we ascribe to several terms which the reader will find throughout the analysis:

> When we speak of an R/D&I system, we are (as we noted earlier) emphasizing the need to consider all parts of a total process of innovation -- i.e., to have a systems perspective. When we speak of an R/D&I "system," we do not mean to imply that it actually does or should exist in any "full blown," clearly-linked, centralized, authoritarian sense. In other words, the term "system" is used descriptively, not prescriptively -- though of course analysis may lead one to conclusions about what kind of R/D&I system is feasible, desirable, etc.

When R/D&I is viewed from a broad-scoped perspective as a "system" or as a total process of innovation, consideration must be given to such issues as the need for balance among R/D&I functions, developing synergy among projects of various funding agencies and the like. We thus use the term orchestration both to connote such a broad-scoped perspective of system/innovation process interactions (and their impacts) and to suggest that to suggest that such interactions (and their impacts) need not necessarily be left to "random chance." At the same time, the mode of and R/D&I system actors performing orchestration can vary (including naturally emerging processes). Thus, while the concept of orchestration does imply purposeful, proactive activity from an overview perspective, it is not meant to imply tight, centralized control.

We recognize the distinction between research and technology on the one hand and science on the other -- and that technology is not necessarily driven by science.

R/D&I systems do go through various stages of maturation. We do not posit a neat, clean-cut linear process of maturation -- indeed, different elements of an R/D&I system may be at different levels of maturation at any given point in time. At the same time, the characteristics, needs, requirements and capabilities of a mature R/D&I system are different than for an immature R/D&I system -- with potentially critical policy implications.

In relation to R/D&I, the term users commonly refers to persons or institutions in an operational, practice setting -- i.e., those who use the outputs of knowledge production processes. For descriptive, categorizing purposes this broad distinction between knowledge producers and knowledge users is valid. At the same time, it is important to recognize that knowledge users can also be knowledge producers (and vice versa), perhaps especially in a sector such as education.

> Another term which appears in many of the analyses is lead agency. Here, we would make three comments. First, the concept of a lead agency is one that "grew out of" our initial contextual R/D&I policy analyses (and in particular, from the agency/field analysis) -- we did not "bring" this concept to these analyses. Second, by "lead" agency, we mean an agency which: (1) has an overview perspective; (2) has (or is perceived to have) some kind of responsibility for an R/D&I system as a system; (3) has at least some resources with which to fulfill this responsibility; and (4) is one of several agencies or institutions concerned with some aspect of R/D&I. We do not mean that: (1) any kind of monolithic, centralized control exists, would be possible, or is desirable; (2) any single agency would be the sole lead agency in a given sector (indeed, it is more likely that several agencies or institutions could be seen as lead agencies); (3) the agency must be the major funding agency (NIE, for example, is not and yet it can be considered a lead agency. Third, we have in more recent analyses (e.g.: the coordination analysis in Chapter Six), taken more note of lead roles, in effect broadening the lead agency concept.

The reader may note that all of these terms reflect a broad-scoped perspective of R/D&I. This is deliberate. It is a perspective which is inherent in the concepts of contextual analysis and of R/D&I as a total process of innovation. It is also a perspective which, we believe, must inform more narrowly-focused policy issues. At the same time, we recognize (and emphasize) that policy, strategy and management decisions and actions must also be informed by an understanding of more situation-specific specific dynamics, characteristics, needs, requirements, etc. Indeed, we emphasize that contextual analysis is a process of interacting broad-scoped and situation-specific perspectives. The ERDA analysis (Chapter Seven) is an example of such an interaction for the purpose of developing program planning (project selection processes for use by a specific division of ERDA).

VI. EIGHT CONTEXTUAL R/D&I POLICY ANALYSES: BRIEF PREVIEWS

Having looked at the eight contextual R/D&I policy analyses from a collective perspective, we will conclude this introduction by providing the reader with a brief summary review of each of the eight analyses.

1. Agency/Field Relationships in the Educational R/D&I System
October 1976

As presented initially to us by NIE, the concerns of the Agency focused on two questions of procurement policy: (1) the appropriate balance between "field-initiated" vs. "NIE-directed" R&D; and (2) the appropriate mechanisms for procuring either field-initiated or NIE-directed work. Since these two questions are special cases of the broader and more critical issue of how NIE and the educational R/D&I field should relate, it was agreed that the policy analysis would focus on the agency/field issue.

In thinking about this issue, we were struck by the rather fundamental and broad-ranging implications of the questions raised, especially when viewed from the perspective of our understanding of R/D&I systems and processes and of the total, interactive processes in which R/D&I systems and processes exist and operate. Thus, there were some fundamental concerns which needed to be examined if the questions posed by NIE were to be responded to in an operational, policy and strategy relevant manner. These fundamental concerns included:

1. the nature of NIE's purposes and roles as a mission-oriented, lead agency in relation to educational R/D&I;

2. the impact of NIE's funding policies on NIE's purposes (as these impact on the total educational R/D&I sector);

3. the multiplicity of NIE purposes (including, in addition to substantive R/D&I outputs: building educational R/D&I system capacity; affecting the system's environment; providing system stability; system orchestration);

4. a large and diffuse operational system for education (i.e., the users of educational R&D products);

5. the relatively immature and loosely-linked nature of the educational R/D&I "system";

6. the differences in appropriate agency/field relations across the different R/D&I functions.

We were also concerned with considerations of program and project "portfolios" that would permit synergy and orchestration both within NIE and within the educational R/D&I system; with latent as well as the manifest purposes implications of specific programs, projects, policies and strategies; with non-procurement as well as procurement policies and strategies; with the nature and implications of a variety of strategies by which an agency can relate to various parts of the field.

In this analysis, we analyzed the agency/field issue separately for four key R/D&I functions: research (both basic and applied), development, dissemination and evaluation research. Each of these, in turn, was analyzed in terms of (1) the generic nature of the function; (2) the educational context; and (3) the implications for the role of NIE. A comparative analysis was then performed across these four R/D&I functions. This comparative analysis revealed several common themes (most specifically: a requirement for NIE leadership; system building; and orchestration as the major NIE role) and some significant differences (most specifically in relation to time frames, the meaning of "excellence" for each function and key criteria for project selection). Finally, two brief scenario analyses were provided to illustrate how this policy analysis might affect policy and strategy decisions.

2. Assessment of Educational R/D&I

December 1976

Institutionalized Research, Development and Innovation (R/D&I) in education is little more than a decade old -- yet the R/D&I system capacity (as we can assess it now), our understanding of the system and our ability to manage it have increased significantly.

There is now a need to develop and refine, over the next few years, an analytical framework and a relatively unobtrusive monitoring system (for data gathering) with which the educational R/D&I system could be assessed in terms both of progress made to date and of what might reasonably be expected in the near term and longer term future. Such an assessment would provide the basis for annual or periodic reviews of the educational R/D&I system.

The analytical framework and the monitoring system for such assessment could be developed from a growing knowledge of R/D&I in other sectors and of the conditions pertinent to the education sector in particular.

In this brief overview report, we have suggested in broad terms what such a framework might look like; what should be the basis for assessment in the current and succeeding periods; what is the current status of key elements in the system and reasonable near and longer term expectations for (based on the incomplete and tentative evidence and impressionistic judgements available at the time); and finally what major needs require consideration in formulating federal policy and program initiatives.

This report is based on some key premises:

1. that however weakly linked or integrated, the institutions and personnel involved in the production and utilization of educational R/D&I outputs do form a "system" and not just a group of disaggregated entities;

2. that R/D&I systems characteristically go through various stages of growth and development, with different needs and dynamics being present at different stages of development;

3. that over the past two decades, federal funding policies have reflected an increasingly broadening perspective of what constitutes an educational R/D&I system;

4. that these premises or perspectives have significant implications for long term planning and monitoring and for the development of initiatives by a federal agency.

This report has three parts: (1) an assessment of the development of educational R/D&I system capabilities over the past two decades; (2) an assessment (including a discussion of the basis for assessment) of the current status and needs of major R/D&I functions (specifically: basic research, problem-focused research, development, dissemination and evaluation research); and (3) a summary which suggests a general format for federal funding of educational R/D&I.

While we do throughout the report note weaknesses in the educational R/D&I system, we also emphasize that the current state of the educational R/D&I system must be assessed in terms of where it has been and where it now has the potential to go -- not in terms of unrealistic expectations about "progress and output to date". Thus, it is important to note that what we have found would be generally about what one would expect to have found within a relatively young R/D&I system. There are weaknesses, but there has been progress and there are signs of the beginnings of a transition from the introductory stages of development.

3. Strengthening Fundamental Research Relevant to Education August 1977

One part of NIE's overall responsibility is fundamental (basic) research relevant to education. In order to better fulfill this part of its responsibility, NIE sought the advice and counsel of the National Academy of Sciences (NAS). Their advice and counsel were presented in a report entitled: "Fundamental Research and the Process of Education" (1977). In response to the NAS report, the Program Committee of the National Council on Educational Research (NCER) presented a series of policy recommendations. Most notably, the NCER Program Committee recommended that 20% of NIE's total budget be allocated to fundamental research by 1979 and at least 30% by 1985.

While agreeing with the NAS conclusions that fundamental research relevant to education does need to be strengthened, there were a number of significant and potentially very dysfunctional deficiencies in the NAS report, and especially in the NCER Program Committee recommendations. For example, inadequate consideration was given to:

1) NIE's broad scope of responsibilities which cover many areas relevant to education -- e.g.: development, dissemination, as well as the improvement of education as a practice -- NIE cannot consider policies and strategies for fundamental research apart from its other responsibilities.

2) the impact that NIE policies and strategies regarding fundamental research could have on these other areas of NIE's responsibilities;

3) the policy and strategy implications of a number of critical aspects of the educational R/D&I context -- e.g.: the importance to education of experience-based knowledge vis-a-vis research-based knowledge; the nature of the educational fundamental research personnel and institutional bases (number; quality; interest and commitment to education; current capabilities to productively use what levels of increased funding; how fast they can be "built up"); the relative immaturity of educational R/D&I;

4) the role of NIE as a governmental, funding and "lead" agency in relation to the educational R/D&I context;

5) rationales or criteria to guide the policy and strategy deliberations of NCER and NIE.

Most specifically, the NCER Program Committee does not provide a rationale for recommending that 20-30% of NIE's total budget be allocated to fundamental research. Indeed, this recommendation appears to us to be highly dysfunctional when one considers that NIE has many other major responsibilities; that the costs for such R/D&I functions are significantly higher for applied research and for development than for fundamental research; that such a level of resource allocation could not help but restrict NIE's program planning flexibility.

Finally, the NAS report could be interpreted as providing a rational (1) that NIE is not needed as a funding agency; and/or (2) that there is no need to fund fundamental research whose focus is education per se.

This policy analysis, then, was developed to call attention to issues such as those above; to place consideration of fundamental research in a broader perspective of a total process of innovation, of NIE's more broadly scoped roles, and of the educational R/D&I context; and in so doing, to help provide a sounder basis both for the NAS committee's basic conclusion (that fundamental research relevant to education should be strengthened) and for policy/strategy decisions related to the conclusion. In this analysis, we do suggest a funding strategy as an alternative to the recommendations of the NCER Program Committee, as well as specific funding purposes and other non-funding strategies.

4. Regionalism in the Educational R/D&I Context

December 1977

As with the issue of agency/field relations, the issue of regionalism in the educational R/D&I context was selected by NIE. The importance of regionalism as an issue for NIE can only be understood in terms of the interactive impact on NIE of two aspects of the educational R/D&I: the "regional" educational R&D labs and the political environment of NIE.

First, in the mid 1960's, twenty educational R&D labs were established by the Office of Education (OE) under congressional legislation. By the mid 1970's, only eight of these labs remained, and their regional orientation had been lost to a very great extent. Currently NIE has responsibility for (and allocates a significant portion of its budget to) these remaining labs, even though they are autonomous organizations and are not technically a program of NIE.

Second, NIE's re-authorizing legislation specifies that a significant portion of NIE's budget be used to insure that the educational R&D needs of all regions of the country are met. The intent of the legislation appears to mean support for regional educational R&D labs, and the legislation has been so interpreted by the National Council on Educational Research (NCER Resolution 18).

At the outset of this analysis, we noted a lack of clear and common understanding about regionalism per se: nature and meaning of regionalism; the factors and dynamics which most critically impact regionalism; the contextual forces which push for or against regionalism or particular kinds of regional approaches; the nature and implications of alternative ways of conceptualizing and designing for regionalism. Thus, we chose to attempt to understand regionalism in ways that would be helpful to policy makers. In so doing, we found we were, in effect, breaking much new ground.

To develop such an understanding of regionalism we chose first to examine the context for regionalism. Thus, the analysis first overviews both the educational R/D&I context and the federal context (since NIE is a federal agency). As a next step, the analysis develops an understanding of conceptual and operational aspects of regionalism. The third step was to look at regionalism in relation to the various R/D&I functions. The final step, then, was to ask how these various aspects of the regionalism issue converge and interact in terms of designing for regionalism from the perspective of a mission-oriented agency such as NIE.

5. A Contextual Approach to Program Planning
September 1977

Unlike the rest of the materials in this collection, this piece does not provide a completed policy study. For the reasons to be later described in the preface to this paper the project could not be carried out as planned. However, the introductory section had been written prior to the aborting of the project and this contained some concepts which added an important dimension to our work. As such it was submitted to NIE as an interesting think-piece, and is therefore included in this spirit as part of the total collection of policy studies.

The paper focuses on the political context of the program planning process, but recognizing that NIE functions at the intersection of the political and scientific systems of which it is a part. As such, it elaborates on a point made in the Agency/Field Relations study in which we pointed out the need for NIE to take into account not only programmatic outputs, but also impact on the R/D&I system and its constituency, in its decision making.

The paper goes on to focus on the inadequacies of process and rational-systems frameworks for program planning and to make the case for the building in of political considerations in planning, namely such requirements as the need "to satisfice", to base policy making on incremental steps, etc. This then becomes integrated into system-wide considerations, which were to have included (but have not been developed in this paper) the implications for all the R/D&I system features (funding, personnel, research, development, dissemination, and so on). This leads to the recommendation that program planning should be conducted within a two dimensional framework, at the program level (in terms of values to NIE stakeholders: political system building) and at the project level (across the functional features of educational R/D&I: R/D&I system building). Finally, some considerations for the monitoring requirements to be generated are discussed.

6. R&D Coordination in the Social Science Context
November 1977

This analysis is a summarization (in modified form) of a paper presented at the Conference on Social Research Organizations at the University of Pittsburgh on October 20-22, 1977.

Coordination is a critical issue from a number of perspectives: Among the various R/D&I functions; between knowledge producers and knowledge users; among the various institutions and personnel and across the various programs within a specific R/D&I function such as research; in terms of R/D&I system maturation and development; between funders and the "field"; and so on. Further, in the social science context, R&D coordination is especially problematic.

In this policy analysis, we view coordination from a broad rather than a narrow understanding of the concept of coordination -- a broad understanding which is not limited to issues of timing, resource allocation and integration in selection to specific programs, projects and related personnel activities. Rather, our understanding of coordination is one which focuses on the nature and needs of a total process of innovation, which considers the meaning of coordination in relation to a total process of innovation; to an R/D&I system of which specific organizations and their programs, etc., are a part; in relation to the larger context within which the R/D&I system and its organizations, programs and personnel exist and with which they interact; in relation to R/D&I system needs and purposes as well as the needs and purposes of organizations and their programs.

We have in this analysis attempted first to gain an understanding of the context of social science R&D can impact and be impacted by social science R&D coordination. Thus, we have in this analysis raised issues of R&D system maturation, emergent process of coordination, lead roles and agencies, and the nature of problems associated with the purposes social science R&D coordination might be intended to serve. These are, we believe, the type of issues which are critical for R&D coordination in the social science context.

7. Analysis, Selection and Planning of Programs and Projects by the Division of Industrial Energy Conservation of the Energy R&D Administration: Phase One Report
September 1977

The Industrial Energy Conservation Division (INDUS) of the Energy

Research and Development Administration (ERDA) has a mission which is broad in scope; requires consideration of many complex factors; must often be accomplished under conditions of high uncertainty or risk; and may involve conflicting governmental goals. Further, consideration must be given to the fact that INDUS must accomplish its mission as a "lead agency" among many autonomous institutions (industries) which have a large degree of ultimate control over the accomplishment of INDUS's mission. Further yet, since INDUS is a funding agency, there will be a "multitude of voices" besetting and beseeching the Agency for funding.

Thus, it is imperative that INDUS have a process for the analysis, selection and planning of programs and projects which:

1) permits analysis, selection and planning to be grounded in a comprehensive knowledge of the broad range of relevant system and environmental factors;

2) at the same time, permits identification of those factors which are most critical and/or about which current information is inadequate;

3) takes into consideration not only the knowledge production issues of R&D but also the "downstream" knowledge utilization issues and linkage issues of need identification, dissemination (including marketing, distribution, diffusion) and evaluation;

4) takes into consideration the nature and dynamics of the relationship between INDUS as a funding, lead agency and the "field" of knowledge producers and knowledge users;

5) takes into consideration both long and short term needs, dynamics and program/project implications;

6) permits orchestration and synergy across programs and projects.

This report, then, focuses on the development, in a manageable and useful format, of such an analysis, selection and planning process. The process suggested builds upon but extends current INDUS processes. It distinguishes between mission areas, programs and projects; thus projects are not considered in isolation but in terms of "portfolios" (i.e., programs). It provides both for organizational memory and for monitoring.

This report is a "phase one" report. It provides a basic outline of an analysis, selection and planning system in the form of flow charts and of specific questions to be raised at various stages of the selection and planning process. These are tentative and will require considerable interaction with INDUS personnel in order for the system design to be "tailored" to the specific context and needs of INDUS. This will be the focus of "phase two" of this project.

8. A Contextual Approach to Development and the Role of Technology in Developing Countries
September 1977

The subject of the role of technology in development of LDCs (Less Developed Countries) has received a great deal of attention in economic, science policy, R&D management and innovation literatures. To date, however, our knowledge is fragmented and often conflicting. Two of the prime bodies of the literature are focused on questions of:

(1) "Appropriate Technology" -- which is concerned with what kinds of technologies are appropriate to LDCs with their low capital and high unskilled labor availabilities as compared to the converse for the western nations, which are sources of most technology; with the implications that the technologies which have been exported from the advanced nations to the LDCs have not been appropriate; and

(2) "Dependency Theory" -- which criticizes the role of the western nations in third world countries (in terms of their having denuded LDCs of capital stock and of having replaced political colonialism with economic and technology based control).

These two perspectives find little integration in the existing literature. Nor do we find much to guide us in developing a comprehensive perspective as to the conditions that are determinate of appropriateness. Nor are we presented with any entry points to break into the dilemma between the desire to avoid dependency and the need to benefit from the sources of most technology that reside in the West -- usually within multi-national corporations (MNCs).

There was clearly a need to have a framework of analysis that could identify the rich complex of variables (political, economic, social, cultural and technological) that needed to be considered, and within which the tensions could be resolved. Besides being able to say what really did make a given technology more or less appropriate or what did/should determine the choice of techniques, we needed to be able to go further and identify "appropriate products," "appropriate R&D systems," etc. Clearly, the problems called for contextual analysis. In this work we are embedding the existing bodies of theory and current political issues (national and international) in our analytical scheme.

REFERENCES

Cain, Harry, "Lindblom: A Partisan Analyst of the Policy Process", in Policy Sciences, Vol. 2, No. 2, June, 1971.

Dror, Yehezkel, "Rationality, Fanaticism and War Initiation: A Theoretical Model and Its Application to the Middle East", in Gabriel Shaffer, ed., Dynamics of a Conflict, Humanities Press, 1975.

George Washington University, "Program of Policy Studies in Science and Technology: Report; 1968-1969".

Lasswell, Harold D., "The Emerging Conception of the Policy Sciences", in Policy Sciences, Vol. 1, No. 1, Spring, 1970.

Lindblom, Charles E., The Policy-Making Process. Prentical-Hall, Inc., 1968.

Radnor, Michael, Harriet Spivak and Durward Hofler, Research, Development and Innovation: Contextual Analysis. NIE monograph; Northwestern University, The Center for the Interdisciplinary Study of Science and Technology, December, 1977.

Radnor, Michael, Michael J. White and David A. Tansik, "Problems and Prospects for Management Science and Policy Science", in Michael White, Michael Radnor, David A. Tansik, eds., Management and Policy Science in American Government. Lexington Books, 1975.

CHAPTER ONE

AGENCY/FIELD RELATIONSHIPS
IN THE EDUCATIONAL R/D&I SYSTEM:

A POLICY ANALYSIS FOR
THE NATIONAL INSTITUTE OF EDUCATION

October 1976

CISST Project Team:

Michael Radnor
Harriet Spivak
Durward Hofler
with the assistance of
Earl C. Young

PREFACE

I. THE CONTEXT OF THE ISSUE

Before beginning our analysis of the appropriate balance between "Field-Initiated and Agency-Directed" R&D, it will be important to frame the issue in its proper context. This can be introduced by a brief discussion of some central questions for NIE today.

What are NIE's responsibilities towards U.S. education in general and educational R&D in particular? How can the Agency utilize a very limited budget for the best short and long term effect, and how might it justify a proper increase in this budget? These are central policy questions, as are such related issues as: the number and types of personnel required within the Agency; the proper place of an in-house Research effort (if any); how NIE should relate to the "Field"; the current priorities for NIE in the "Field"; and NIE's relations with other Agencies that may be playing roles in either educational R&D or in educational practice.

Any attempt to deal with these issues must begin with a recognition of their inter-connectedness. For all its looseness, its inadequacies, there is an educational R&D system to be dealt with and NIE is a critical element of that system. What is done in one area or in relation to one issue will likely affect other areas and have impact on other issues. For example, the build-up of development efforts in the past has had implications for the state of Applied Research and the needs and opportunities for Dissemination now. What the Agency adopts as its mission will determine its budgetary priorities and in turn how it should and could relate to the Field.

The recognition of the current state of educational R&D (including the total innovation process) is as critical as the recognition of its systemic character. It is loose; gaps are characteristic; and inadequacies are all too common. In short, it is a very "immature" and weak R&D system. What then are the implications of these two characteristics of being a system and being immature and weak?

If education is to be served by a quality R&D system, two major requirements will need to be satisfied. These involve (a) system building, maintenance and protection and (b) system orchestration.

Only futility and frustration can come from policies that ignore the state of the educational R&D system; policies which implicitly assume: viable Research/Development/Dissemination and other institutions which are reasonably well linked to each other and to practice; policies which assume that Users are able to adopt quality R&D outputs, able to properly generate and implement their own significant innovations and able to identify and feed forward their real needs to Developers, etc.; policies which assume that the provision of funds to procure R&D outputs and programs are the primary requirement for success. We suggest, in contrast, that system building, institution building and rebuilding, and personnel development are top current priorities for educational R&D. Further, it is not enough merely to build. A fragile, politically exposed and weak system must be maintained and protected.

A mature R&D system orchestrates itself. Relationships are well developed. Participants know what to seek and to deliver, from and to where, and what to expect and trust. An immature system needs help to grow, to learn how to achieve such a self organizing state.

These are the needs. NIE may not be the largest governmental contributor to the educational R&D establishment, but it is the lead, the core discretionary agency. NIE must take responsibility for the system building and orchestrating. No other body can or will. NIE could walk away or be prevented, politically, from assuming this mission; but the need would remain, as well as the ensuing frustration. In our analysis we have taken the assumption of this mission as a given, along with our premise that there is an educational R&D system, albeit immature and weak.

This sets the scene for our analysis. If we are to understand the factors that determine the what, when, how much and how of the "Field-Initiated vs Agency-Directed" R&D issue, it must be in terms of our understanding of the total educational R&D system as it now is; as we might wish it to become; and as it varies across the differing elements of the system (e.g. as between Research and Development). To do this we need an appreciation of what is fundemental and generic in R&D and what is characteristic of the present educational R&D context.

Such understanding will need development and presentation if we are to be able to deal with the issue at hand. It may, incidently (because of the aforementioned inter-connectedness of system issues) also provide some insight to the type of questions raised at the start of this preface. Some very brief thoughts on those questions may be a fitting introduction and entrée into our analysis.

II. SOME RELATED ISSUES

The limited size of NIE's budget in relation to the needs, and even in comparison to what is being spent in total on educational R&D, is well recognized in the Agency and in the National Council on Educational Research. What are some insights that may be helpful in developing parameters and guidelines for budgetary planning that may be derived from the analysis that we present below?

This is clearly a large policy issue and we can only hope to suggest some useful perspectives in these few comments.

We would need to begin with an evaluation of the capacity of the R&D system, overall and across its parts (or functions as we will be terming them--Basic Research, Problem-Focused Research, Development, Dissemination, etc.). What is there now (in terms of capacity, product inventories, etc.)? What can be delivered? What is needed (capacity, outputs) now and over the longer term? In our analysis we will point out the needs and requirements of the different functions--and how these may differ over time.

Specifically, in our analysis we will note that because of funding policies in relation to the Development function, there are some quality Development organizations and an inventory of Development products. What has been missing have been the quality control function, the Developer/User linkage and the User/Product matching (and tailoring) functions. We will further note in our analysis that the Problem-Focused Research and (until recently) the Dissemination functions have not been well developed and are weak. We will note that overall the educational R&D system is relatively immature.

To illustrate how these budgetary parameters might be applied, let us consider what a "balanced" funding process for Research, Development and Dissemination might be, given the existing state of these system functions.

As we noted, a relatively large amount of funding has been provided in the past for Development, while Problem-Focused Research and (until recently) Dissemination has been relatively less developed. Thus, a "balanced" budget plan might be:

1. Since there are now a sizeable number of Development products available, reduce current Development funding--to that minimal level necessary to maintain the existing high quality centers.
2. Since Dissemination has been so recently fragmented, direct significant funding to Dissemination--but not so much as to build a system that would overwhelm Users. At this time, quality control, sorting and technical service would likely need to be a part of the function.
3. Since large scale Problem-Focused Research has been neglected, provide major funding here for system building--but not at a level greater than the capacity of the function to absorb productively.
4. Provide moderate funding for Basic Research, for long-term system-building purposes.

A funding strategy such as the above would, of course, have to consider existing funding realities, political conditions and the particular current needs of Users.

Additional considerations will be important for such a "system building" budget and policy orientation. For example:

1. There must be funding stability over time. System building is a sustained rather than an "in-and-out" process. A three to five year period would be minimal for any kind of system building--and would be completely inadequate in the Research function. For total system building, a much longer time frame is required.

2. System building is different from procurement of a product, and this fact has significant implications for funding policies. For the procurement of a product, open competitive bidding is often a systemically valid strategy because the product (not an institution) is the concern. In system building ing, the reverse holds true--the institutional (and personnel) base is the primary concern--not a product.

3. From the political point of view it may be vital to attempt to educate the relevant communities as to the state of the educational R&D system and to the fact that the next few years have to be seen as a period of long term capital investment--if we are not to be burdened in the future with the errors of the past as we seem to be today. Perhaps this is the only meaningful justification that can be used for added Agency funding that will not return to plague educational R&D in the near future.

These last points warrant further consideration. As we will note in the analysis, system building requires continuity and concentration. Direction and orchestration must be provided from some system-wide agency such as NIE. Thus, Agency efforts cannot be scattered and non-directive and still be effective. This, in turn, implies a tighter degree of selectivity and control by the Agency than would be possible under standard RFP and competitive bidding procedures. Thus, there is a dilemma--there are legal and political constraints involved in a "sole source" approach (which would be a relevant mode of funding for system building purposes).

Thus, as our analysis will indicate, it becomes important for NIE to know what is needed, to be aware of the legal/political constraints, and to find ways to mediate the tension between needs and constraints--i.e., meeting the needs without violating the constraints. Perhaps one mode of such mediation would be for NIE, acting in consort with other agencies facing the same tension, to apprise the Congress and other relevant groups of the long-term requirements for system building as contrasted to procurement approaches to funding, given the current system state and needs.

In the above discussion, we have touched upon two other issues relevant to NIE which are discussed in our analysis: inter-agency coordination and internal NIE staffing (especially the question of an internal NIE Research capability).

Although a detailed analysis and discussion would be beyond our current scope of effort, our analysis indicates that inter-agency coordination and orchestration is a key NIE role--both because NIE is the lead agency in educational R&D and because more funding of educational R&D is provided outside of NIE than by NIE. As we noted earlier, this may at times mean that a significant portion of NIE efforts may be applied toward a specific critical area even though relatively little of NIE's budget is applied to this same area. Stated another way, NIE's focus of concern should be with needs, not only with the implications of its budget per se.

Our analysis also suggests that the way NIE provides for its own internal staffing will have a critical effect on the direction and effectiveness of the Institute. For example, the NIE role of orchestration requires personnel who have skills in orchestration and in facilitating collaboration between people and/or between institutions and agencies. Additionally, NIE will need some personnel who have "political savvy". For another example, our analysis will suggest a need to build the Research function and will further suggest that only by having an internal Research capability will NIE be able to orchestrate the building of the Research functions.

We might also comment briefly on the issue of NIE "rules of thumb" (such as: "only offer a grants competition when a total of one million dollars can be provided and when you can fund 25% of the proposals submitted"). We would not be concerned with the amount and the percentage figures per se. Rather we would note that there is an inherent system logic in such a rule of thumb--i.e., it is correct that the expectations of the field should not be raised beyond reasonable levels of potential for fulfillment. We would further note, however, that "rules of thumb" tend, too often to fall into the trap of ignoring critical system or function dynamics, conditions, needs and requirements. In the above case the danger would be that such a grants competition would be used in an area so lacking in Excellence that the funding of 25% of proposals at the one million dollar total level would tend to trap the Agency into indeed providing the funds to low quality, low-success-probability projects.

One final comment. Our analysis may at first glance appear overly-extended for such a "simple" problem as the Field-Initiated vs. Agency-Directed Issue. Our point is precisely that this is not a simple question--it is embedded within other more fundamental system issues, and NIE's response will have system-wide impact. Thus, the only appropriate analysis is a system analysis. Additionally, this analysis has shed light on other issues confronting NIE--a good illustration of the "multi-purpose effects" concept we will introduce in this report.

III. REPORT ORGANIZATION AND PREPARATION

In the pages that follow, our report will:

1. describe our method of analysis;
2. analyze the NIE/field relationship issue from both the generic and educational context perspectives in four major functional areas of educational R/D&I--Research, Development, Dissemination, and Evaluation Research;
3. outline potential implications of the analysis for NIE policies and strategies in each of the four functional areas;
4. provide hypothetical scenarios to illustrate the implications of potential policy and strategy decisions of NIE.

The policy analysis is framed within the overall contextual issue of the relationship between a mission-oriented federal agency (NIE) and the operative R/D&I community in a specific sectoral context (education in the United States). The specific issue of Field-Initiated vs. Agency-Directed Procurement is treated as a sub-issue of the larger Agency/Field relationship issue.

Reference

Seiber, Sam D., "The Requirements of a National Educational R&D System" in Educational Researcher, December 1975 (p 3-6).

This policy analysis has been prepared by staff members of the Northwestern University Center for the Interdisciplinary Study of Science and Technology under contract # NIE-C-400-76-0110.

The Center is an interdisciplinary Research center that exists to focus the broad and varied interests of a number of Northwestern University faculty concerned with the moral, philosophical, cultural, social, economic, and political significance of science and technology. An area of special concentration is on R&D management systems and problems as they are encountered in a variety of sectors (e.g., industry, law enforcement, and education). The Center brings together interdisciplinary talents from such diverse fields as management, economics, history, philosophy, education, journalism, the physical and biological sciences, engineering, psychology, sociology, anthropology, and religion. Faculty and staff associated with the Center are drawn from several organizational units of the University, including personnel with appointments in the Graduate School of Management, the School of Education, the College of Arts and Sciences, the Technological Institute and others. Center Associates are affiliated with universities and Research institutes across the country and in a number of other nations.

DEFINITION OF ISSUES AND METHOD OF ANALYSIS

TABLE OF CONTENTS

PREFACE i

DEFINITION OF ISSUES AND METHOD OF ANALYSIS 1

RESEARCH 22

DEVELOPMENT 70

DISSEMINATION 113

EVALUATION RESEARCH 172

SUMMARY ANALYSIS ACROSS FUNCTIONS AND CONTEXT: IMPLICATIONS FOR THE ROLE OF NIE 204

SCENARIO ANALYSES 242

DEFINITION OF ISSUES AND METHOD OF ANALYSIS

I. ISSUE DEFINITION

1. Initial NIE Concerns
2. Our Reformulation of the Issue
3. The Relationship of this Analysis to Current NIE Analysis of this Issue
   - A. Review and Interpretation of the Duffy Report
   - B. Our Approach
4. NIE Purposes
   - A. The Multiplicity of Purposes
     1. Substantive outputs of the R/D&I system
     2. System capacity building
     3. Affecting the system environment
   - B. Manifest and Latent Purposes
   - C. Interaction Effects
5. The Functional Context of NIE Purposes
   - A. Research
   - B. Development
   - C. Dissemination/Implementation/Utilization
   - D. Evaluation/Policy Research
6. R/D&I System Context
7. The Spectrum of Agency Behavior
   - A. Types of Behavior
     1. Procurements
     2. Non-procurement system behavior
     3. NIE internal actions
   - B. Types of Strategies
     1. Degree of Agency control
     2. Degree of Agency involvement
     3. A strategy continuum
8. A General Analytical Model

II. METHOD OF ANALYSIS

1. General Methodology
2. Specific Analysis Method
   - A. Functional Analysis
     1. Generic characteristics of the function
     2. The Educational context of the function
     3. Implications for Agency behavior
   - B. Cross Functional Analysis
   - C. Scenario Analysis

FIGURES

1. Appropriate NIE Behavior as a Function of NIE Purposes and the R/D&I System Context
2. Simplified Analysis Matrix
3. Scenario Analysis

DEFINITION OF ISSUES AND METHOD OF ANALYSIS

I. ISSUE DEFINITION

1. Initial NIE Concerns

As presented to us by NIE, the concerns of the Agency focused on two questions of procurement policy. Foremost was the question of determining the appropriate balance between "Field-Initiated" versus "NIE-Directed" R&D. The Agency had been receiving considerable criticism from the field, reflecting the view that too limited a role was permitted the field in the design of either broad programs or specific procurements. Many of those unhappy with the present character of procurements were suggesting that the Institute commit itself to a predetermined funding percentage for field-initiated R&D. The expectation was that such a predetermined set-aside formula would create a larger flow of funds into field-initiated work than had recently been the case. The National Council on Educational Research, in its desire to be responsive to the field, requested a review of NIE procurement policies and some careful consideration of the question of how Agency policy might be developed on the matter of the appropriate balance between Field-Initiated and NIE-Directed R&D.

A second, related question involved determining the appropriate mechanisms for procuring Field-Initiated and NIE-Directed work. Of particular concern were questions about the nature and extent of direction that an agency could justify building into procurement mechanisms, specifically with the requirements and language of RFPs (as these might constrain project conception, design, execution, etc.) and most particularly whether the RFP should be used at all in the R&D funding context.

2. Our Reformulation of the Issue

In thinking about these questions, we were struck by the rather fundamental and broad-ranging implications of the questions raised, especially when viewed from the framework of our understanding of R&D

systems and processes. In order to deal with these far-reaching issues in a meaningful way, it seemed to us that there were some critical prior questions to be addressed and clarified. Therefore, we proceeded to reformulate the questions of concern to the Institute in a manner that we felt would best permit us to shed some light and suggest some directions for policy development.

Our consideration began with recognition of two defining features of the Agency's character: first, that NIE is a mission-oriented R&D agency; and second, that NIE is the lead agency for federal activity with respect to Research and Development in education. Given that role, its funding policies would have to be understood in terms of its purposes as these impact on the total education sector's Research, Development and Innovation (R/D&I) system. What the balance of different types of funding should be and how an agency should relate to the field with which it worked would depend on the purposes the agency was trying to achieve across all aspects of the R/D&I system. The nature of this behavior would need to be fitted to whatever it was necessary for NIE to do if it were to achieve its mission in all its R/D&I system aspects. Percentage of field-initiated programs and type of procurement mechanism used could be viewed in this light as indicators or as symptoms of Agency/Field behavior rather than as direct policy leverage points. Therefore, it seemed to us, our analysis could be focused most fruitfully on more fundamental questions concerning NIE's mission and purposes in relation to the field's needs and conditions. Answers to these prior questions, if seen as determinants of necessary Agency behavior, would suggest what the appropriate Field-Initiated/Agency-Directed balances should be at any particular time, and would suggest, too, the most appropriate procurement mechanisms for each individual case. With this set of assumptions as our starting point, we then began to formulate our analytical strategy.

3. The Relationship of this Analysis to Current NIE Analyses of this Issue

In carrying out our analysis the results of recent in-house NIE efforts (specifically the Duffy et al. 1976 memos) were made available to us. We deem it appropriate to point out the areas of similarity and points of departure between our analysis and the NIE in-house report.

A. Review and Interpretation of the Duffy Report

From our perspective, the NIE study was a rich, on-target discussion but one that was acutely limited by its narrowness of focus. We make this criticism on two grounds.

a) The report lacks an overall R/D&I systems perspective, casting its arguments in terms most relevant to the Research function, but far less appropriate to the NIE purposes with respect to, and the generic issues inherent in, such other functions as Development, Dissemination, etc.

b) The discussion was, in our view, more than necessarily couched in terms of a Field/Agency dichotomy (an "us" versus "them" perspective). Rather, it will, as we will show, be vital to recognize NIE's integral place as a part of the educational R/D&I system. Despite these criticisms we would be remiss if we failed to comment on the quality of the analysis within the above stated constraints.

B. Our Approach

By contrast, our approach grows out of and builds on a systems perspective, with NIE's mission being viewed in terms of its impact, as an integral part of the system, on the educational R/D&I system's health, functioning and outputs. Further, growing out of this systems perspective, and as is inherent in our general analytical method, we engage in a broader, more systematic analysis of R/D&I functions and the range of conditions affecting the system. Finally, we note that procurement is but one of the range of behaviors available to NIE by which it can influence the system and that behavior must be evaluated in its totality.

Thus, the essence of the issue as we see it is: how does NIE achieve its purposes through procurements and other Agency actions, taken in consort with and as part of the field?

4. NIE Purposes

A. The Multiplicity of Purposes

Central in determing NIE's proper modes of behavior must be its mission in relation to the educational R/D&I system. While NIE can be conceived as seeking many individual goals these can be usefully grouped under the following general systems dimensions:

1. Substantive outputs of the R/D&I system (knowledge, products, services, etc.) - The systems throughput dimension.
2. System capacity building (institutions, linkages, personnel, etc.) - The level of maturity and capability of the system itself.
3. Affecting the system environment (support, prestige, legitimacy, etc.)- The system environment.

Procurements tend to be thought of primarily in terms of the first of these categories, the direct purchase of R/D&I activities to generate knowledge, produce programs, products, etc., or to provide services. Occasionally, agencies procure capability-building activities directly, as in the provision of institutional support, or the funding of training programs or graduate or post-doctoral fellowships. But for the most part, procurements are designed and managed by agency personnel as individual projects or programs designed to produce specific outputs for the use of the operational system or the R/D&I system itself.

What tends to be overlooked is the extent to which these manifestly single-purpose procurements tend to have multi-purpose implications: in almost every procurement (or other Agency behavior), more than one of these purposes will be involved, whether implicitly or explicitly. Thus, the award of a grant to an R&D institution to support a specific project may also have an impact on that institution's capacity to perform in the future (e.g. by permitting it to hire additional personnel, by the added experience that may result). Similarly, the provision of an institutional support grant may result in the conduct of R&D programs whose outputs may not have been specifically sought but which are of considerable value, and at the same time act so as to increase that institution's legitimacy vis à vis various of its publics.

Consequently, it becomes essential for an agency to be very clear about its purposes, those entailing system building and affecting the system environment as well as the use of system capacity to produce substantive outputs. And too, it seems important to develop some recognition of the legitimacy of latent as well as manifest purposes for procurements as well as other Agency actions.

B. Manifest and Latent Purposes

The legitimacy of latent as well as manifest purposes of Agency actions is a point that merits some elaboration. The manifest reason for supporting a particular project may have little relevance to the real reason, which is latent, implicit, and infrequently made clear to members of the R&D community and/or relevant publics. A particular project may receive funding not so much because of the immediate payoff expected from the project itself but rather because of the support it is providing for a certain type or group of graduate students, or because it is expected that if a certain Researcher is supported long enough he is bound to make very substantial contributions to the field. In such cases, defending a project in terms of its manifest purpose may be difficult, but justifying it in terms of long-term capability-building needs may be much less of a problem. Or to consider a somewhat different example, an agency may be subjected to considerable pressure to support a particular kind of program, and the pressure may be substantial enough to have serious enough ramifications to jeopardize achievement of important objectives. In such a case, an agency may have little interest in the manifest purpose of a project, but may support it for the latent purpose of relieving undue stress on the system.

The essential point here is that procurements may provide the greatest long-range payoff if they are designed with multi-purposes in mind, and if Agency personnel can design them creatively to serve latent as well as manifest purposes. What would seem to be needed, then, are deliberate Agency strategies to capitalize on the multiplicity of consequences from specific Agency actions, to maximize possible gains and minimize possible costs from potential multiple and interaction effects across the latent and manifest purposes of given procurements.

C. Interaction Effects

This issue of interaction effects is one of the most critical points that seems to be overlooked in the development of Agency policies. Once an Agency comes to view its behavior in terms of interactions among seemingly discrete actions, an entirely different kind of understanding emerges of the potentially far-reaching systemic implications of individual decisions and policies. Different purposes can interact with one another (a point we shall return to shortly). Purposes can interact with procurement mechanisms -- e.g., a mechanism used to procure Basic Research outputs can have major implications for long-term capacity-building. Purposes and mechanisms can interact with contextual conditions, e.g., the state of development of the system; a strategy that may have been ineffective a decade ago may be highly successful in achieving certain purposes now or ten years from now.

The point is perhaps made most clearly by examining potential interaction effects among purposes, both within a single procurement and across the totality of procurements made by an agency. A procurement can lead to the creation of outputs and lead to an improvement in the system environment. Or, it can lead to a deterioration in the environment if, for example, that particular output is seen as offensive to certain key elements. It could also lead to a destruction of R/D&I system capacity by, for example, moving critical resources away from their most productive areas of application.

When one examines patterns of Agency actions across procurements --

i.e., when one considers potential interactions among the discrete procurements that make up an agency's "portfolio" -- interactions of an even less obvious nature become apparent. Across programs, the outputs may reinforce each other (synergistic effects). Or they may counteract each other in the manner of what might be called "anti-purposes" -- i.e., taking a specific action in pursuit of one purpose may make more difficult the achievement of another purpose. The use of RFPs to procure certain kinds of Research, for instance, might well have anti-purpose effects if a by-product is turning off the best Research talents, suggesting to them that Research funding in the field of education is unlikely to be forthcoming without untenable constraints. Such effects may be immediate in their interaction or observable only in lagged and in second- and third-order manifestations. If an agency decides to design procurements that are deliberately multi-purpose in nature, it becomes essential for agency personnel to have a clear understanding of the kinds of procurement "add-ons" that tend to be congruent vs. incongruent with each other, functional vs. dysfunctional.

Portfolio effects may be discernible within institutions as well as across institutions. It is common to observe how R&D institutions become shaped by the patterns of funding that become available to them. If a single agency provides a particularly large share of an organization's total funding, agency actions can have the effect of molding or changing the very character of such organizations.

In summary, then, interaction effects will need to be considered in terms of their:

- synergistic effects
- congruency/incongruency with each other
- lagged (and indirect/second and third-order) effects
- cumulative effects within and on institutions and personnel

The essential point is that multi-purpose effects are inevitable. The issue is not whether there should be multi-purposes but rather whether they are to be recognized or ignored, and if recognized to be dealt with and capitalized upon or anti-purposes minimized.

5. The Functional Context of NIE Purposes

Up to this point, we have considered three sets of purposes that can be affected by procurements and other Agency behaviors. We turn now to consideration of the second major building block of our analytical approach.

NIE's purposes are achieved through the carrying out of various activities that can be categorized by R/D&I functions: Research, Development, Dissemination, etc. Achieving the same purposes (e.g., institution building or affecting the system environment) may call for different Agency behaviors in relation to these different functions. Building Research institutions may demand strategies very different from those required to build Development organizations. The mechanisms that are appropriate for procuring Development products may be quite inappropriate for procuring Basic Research studies, and so forth. Similarly, the types of skills and experience required within NIE to work with personnel and institutions involved in Basic Research are likely to be rather different from those required when working with those involved in the Dissemination function. Therefore, it follows that the determination of Agency behaviors (of all kinds) are likely to be highly dependent on the R/D&I functions with which they are involved, and this consideration must be reflected in our policy analysis.

To make such analysis possible, it was necessary for us to select a set of R/D&I functions that seemed to be reflective of the bulk of the activities that go on within educational R/D&I and that become the object of NIE procurement and other Agency activities. With this in mind, we selected the following R/D&I functions (or groupings of functions)to become the focus of our analysis.*

---

* In the R/D&I systems analysis scheme we use generally, we treat Need Identification as a discrete function. In education, however, where specialized Need Identification mechanisms tend to be lacking, Need Identification is carried out as an integral part of each function. We have therefore treated Need Identification this way in our policy analysis.

A. Research

Research can vary along a series of multi-dimensional continua, generally categorized as going from Basic to Applied. We fully recognize the debate involved in such categorization and the difficulties involved in the usual over-simplification so implied. Nevertheless there are, for our purposes in relation to discussing appropriate Agency behavior, important potential differences between what is required to deal with Basic Research, which is largely involved in the search for knowledge for its own sake, and what is required for applied work that goes on in relation to well-defined problem areas. We will therefore examine these two types of Research as being representative of the range of activities with which NIE may become involved. In thinking through the implications of our analysis for the particular kinds of Research NIE procures, Agency personnel can make the necessary accommodations to variations encountered between these two extemes. The two sub-functions therefore will be:

1. Basic Research (the seeking of knowledge for its own sake)
2. Problem Focused (or Applied) Research. As used here and later in this analysis "problem" refers to a social or practice-centered problem rather than to the kind of intellectual or discipline-based problem that is central to Basic Research.

B. Development

Whereas what we are calling Problem-Focused Research is oriented toward problem areas within education, Development work tends to be focused on the design and elaboration of products, processes, programs, procedures, practices, etc. that attempt to deal with identified problems or needs. For simplicity of usage, we will generally use the term "products" to describe the outputs of the Development process. However, it should be understood clearly that we have the full array of Development outputs in mind -- programs, procedures, strategies, practices, etc. as well as the narrower category of outputs generally thought of as "products."

C. Dissemination/Implementation/Utilization

The functions within this cluster are typically treated separately in R/D&I systems analyses (at least as between Dissemination and the other two). We will link them in this analysis since this is a characteristic of the educational R/D&I system: its relatively low level of maturity and the general absence of institutionalized integral User change agent functions make this a necessity. The focus of our analysis will be placed on the Dissemination function, since it is here, in system-level linkages (rather than within the User setting that shapes Implementation/Utilization), that NIE efforts can have more substantial impact. However, it should be noted that any future expansions of our analysis should involve specific detailed analysis of the Implementation/Utilization functions.

D. Evaluation/Policy Research

Evaluation and Policy Research are often grouped together. In education this seems particularly fitting since Policy Research in education so often involves one or another form of Evaluation Research. However, there are important differences between Evaluation Research and Policy Research, and they may require some extended separate treatment. Since it appears that the bulk of NIE's efforts in these areas are more directly involved with Evaluation Research, we will focus on this function in our analysis. Again, further work could expand on the specific issues related to Policy Research.

6. R/D&I System Context

We have seen up to this point in the analysis that achieving the same Agency purposes may require somewhat different Agency behaviors in relation to different R/D&I functions. But beyond this, for R/D&I functions and their generic requirements to be understood in terms that seem congruent with concrete empirical reality, it becomes important to see each function within a total R/D&I system context.

We define an R/D&I system context as the joint interaction of three elements:

1. the R/D&I functions, as described above.
2. operating conditions within a particular R/D&I system (e.g., the maturity of the system; the types and quality of personnel available; the types and quality of the institutions available; the state of development of the knowledge/technology base; the nature of the information systems and flows among key elements in the R/D&I system--journals, invisible colleges, conferences, etc. etc.; the very nature of the innovations involved).
3. the system environment (e.g., the political/social environment, especially its supportiveness or lack of support for the system; the economic environment; the nature of the knowledge base of the field -- whether it is a natural- or social-science base; etc.).

Therefore, in determining appropriate Agency behavior for achieving a certain purpose it becomes vital to be cognizant of both the system function to which it applies and the manner in which the generic characteristics of a given function are mediated by systemic and environmental conditions. It is this joint effect that we term the R/D&I system context.

7. The Spectrum of Agency Behavior

A. Types of Behavior

While an agency such as NIE can engage in a wide variety of behavior in relation to its purposes, these can be usefully grouped for analysis under three headings:

1. Procurements

An agency's use of the funds available to it to procure specific outputs, institution building, etc. is generally seen as the prime forum for Agency action.

2. Non-Procurement System Behavior

The potential range of Agency behaviors is not necessarily limited to procurements. It may also play a potentially important role in the system through a variety of other kinds of actions. These may include: working with other agencies so as to achieve synergistic and multiplier effects from joint (additive and/or supplementary) activities; having its personnel play an active role as members of the R/D&I community--as Researchers, as participants in conferences, as influences on thinking in various informal interactive modes, etc.; by making information available; etc.

3. NIE Internal Actions

How an agency relates to a field will be importantly determined by what goes on within the agency. Specifically, the strategies and modes of behavior required will be constrained by the extent to which NIE has the number and type (skills, experience, stature) of personnel needed and the organizational and budgetary structures that permit appropriate behaviors.

B. Types of Strategies

Within the above three areas for NIE behavior, there remains a wide and multi-dimensional variety of behaviors in which an agency can engage. These can be condensed along three dimensions:

1. Degree of Agency Control

NIE might see the need to maintain a greater or lesser degree of control over what goes on in the field, in terms both of extent (level) and of domain (program selection, methods used, personnel involved, nature of relationships, forms of reporting,etc.).

2. Degree of Agency Involvement

NIE might choose to be more or less directly involved in what was occurring in the field--for example: NIE participation in the various functions (e.g., undertaking various types of Research, Dissemination, Evaluations, Policy and R&D system studies); planning for and monitoring of the R/D&I system; determining what work to carry out internally and what activities to procure through external contracts or grants.

3. A Strategy Continuum

Seen the above ways, it is possible to array very roughly the types of strategies by which an agency can relate to various aspects of a field. Such an array could be the following:

- Initiate activity for a field
- Supplement what is already going on
- Modify what is already going on
- Select from among what is already in a field
- Educate the field to operate differently
- Mediate external pressures on specific field elements or programs
- Integrate programs, institutions and systems to be found in the field
- Cooperate with other programs (e.g. in other agencies) or with field programs
- Facilitate activity already going on
- Execute activities initiated by the field
- Evaluate activities that have occurred in the field
- Monitor what is going on.

This array, while admittedly rough, represents, jointly, a diminution of Agency control and involvement in what is going on in the field, in both pragmatic and systemic terms. The order is not, however, especially important. To the extent that it does array a variety of possible strategies, it demonstrates a richness that goes well beyond the simple Field-Initiated vs. Agency-Directed continuum. From our perspective, the Field-Initiated vs. Agency-Directed continuum is likely to be most meaningful in relation to individual projects and programs rather than system-based purposes, and in relation to those functions in which programmatic activities can be separated easily from system activities, at least in the short run, as in the case of Research, especially Basic Research.

(And even then the extent to which the FIS vs NIE continuum applies seems related to the extent to which Agency personnel focus on their own individual projects rather than the system as a whole.) The Field-Initiated vs. NIE-Directed continuum is likely to be far less meaningful for such inherently systemic functions as Dissemination, or for system building purposes. Seen in this way a determination of the proper proportion of NIE's budget that should go to Field-Initiated activity could only be made in relation to NIE's agenda, as it played itself out with respect to the Agency's purposes, as manifested in the various R/D&I functions (Research, Development, Dissemination, etc.), under the prevailing contextual conditions (personnel, funding, maturity of the system etc.). As an overall index it would therefore not seem to provide much meaning, and hence not represent a proper actionable policy criterion.

8. A General Analytical Model

As implied above, our analysis will involve the specification of the behavior appropriate to the achievement of Agency purposes in the context of the functional, systemic and other environmental conditions that prevail. Diagrammatically, this can be illustrated as in Figure 1. This model also indicates that NIE's purposes will themselves be influenced by what is going on in the educational R/D&I context and that in turn this context will be importantly influenced by how NIE does actually behave, as an integral part of the educational R/D&I system.

II. METHOD OF ANALYSIS

1. General Methodology

A complete analysis would require examination of how the interaction of NIE's purposes, as manifested in the R/D&I functions, and mediated by the systemic and environmental conditions, determine appropriate Agency behaviors and consequently strategies in relation to the field. The above statement would imply at least a four

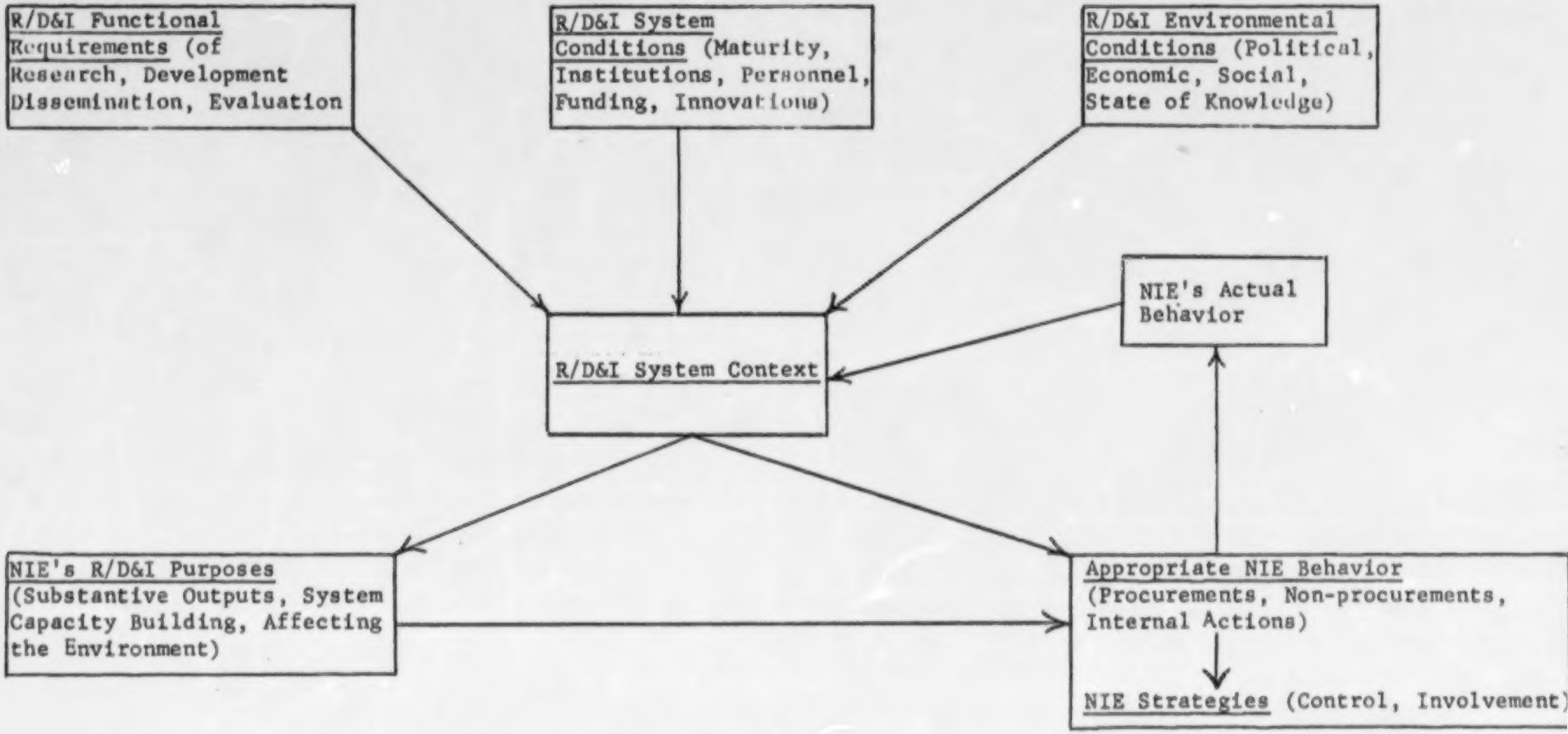

R/D&I Functional Requirements (of Research, Development Dissemination, Evaluation
R/D&I System Conditions (Maturity, Institutions, Personnel, Funding, Innovations)
R/D&I Environmental Conditions (Political, Economic, Social, State of Knowledge)
NIE's Actual Behavior
R/D&I System Context
NIE's R/D&I Purposes (Substantive Outputs, System Capacity Building, Affecting the Environment)
Appropriate NIE Behavior (Procurements, Non-procurements, Internal Actions)
NIE Strategies (Control, Involvement)

Figure 1. Appropriate NIE Behavior as a Function of NIE Purposes and the R/D&I System Context

dimensional analysis. As a simplifying step, we have elected to consider each of the R/D&I functions separately in relation to the combination of R/D&I systemic and environmental conditions, as shown in Figure 2.

	R/D&I Environmental and Systemic Conditions
R/D&I Function	(Appropriate NIE Behaviors/ NIE Strategies)

Figure 2. Simplified Analysis Matrix

The cells of this matrix are the appropriate NIE behaviors which can be built into strategies that the Agency could pursue.

Having conducted the individual analyses for each R/D&I function, it becomes possible to consider the implications for NIE strategy across the functions. Finally, the strategies can be converted into scenarios in which patterns of hypothetical, or actual past or contemplated NIE behavior, are analyzed to suggest likely impacts if implemented as originally formulated, or as reformulated in alternative ways that take into account some of the points we have tried to underscore in our analysis. In the final analysis, one could conceive of converting NIE's total programmatic agenda into an integrated set of scenarios, determining the various patterns of appropriate Agency behaviors (a fallout of which would be an estimate of the percentage of all procurements that would be Field-Initiated--though as we have stated this would not be an index of great significance in an of itself), and suggesting likely impacts.

2. Specific Analysis Method

Within the framework of the above general approach, the procedures to be followed will be as follows:

A. Functional Analyses

Each selected R/D&I function (Research--Basic and Problem-Focused--Development, Dissemination, Evaluation) will be analyzed in the following manner:

1. Generic Characteristics of the Function

We will begin each functional analysis with a review of those generic issues inherent in the function which are likely to be of relevance to educational R/D&I and have implications for NIE behavior. A complete generic review of each function would inevitably deal with many issues that are of relatively lesser concern in education at this time. Given the constraints of time, volume and salience implicit in a policy analysis, we have attempted to be judicious in our selection of issues to be discussed.

2. The Educational Context of the Function

We then consider the current state of affairs in the educational R/D&I system as it relates to carrying out this particular function. We examine contextual issues pertaining to the state of development of the relevant knowledge base, the institutional base, the personnel base, the climate of support for funding its activities, etc. As before, the implications for NIE behavior are drawn. Where feasible, this section concludes with some general guidelines for NIE's operating modes and strategies.

3. Implications for Agency Behavior

In this final section of each functional analysis we attempt to summarize the requirements for NIE behavior in relation to the particular function in its present context, building up some recommendations for Agency strategy.

B. Cross-Functional Analysis

In this critical chapter, we take the analysis and strategy-building a step higher by attempting to draw the cross-functional implications for NIE at a total Agency level.

C. Scenario Analyses

Two illustrative scenarios are then analyzed. Each scenario consists of a description of a hypothetical NIE behavior (e.g., a particular procurement program, its objectives, the manner of its implementation), an analysis of its wide implications (if any) and likely impact, our recommendations as to what changes might (or should) have been made, and the likely consequence of these recommendations. The thinking behind this process is depicted graphically in Figure 3.

A specific NIE action (usually a procurement), with its intended purpose, would result in some consequences. The effects or impacts would be a consequence of the NIE action interacting with contextual conditions, and would have to be understood in terms not only of the intended and manifest purposes of an action, but also any other (possibly latent) purposes. These impacts would be evaluated and appropriate strategy alternatives recommended. Such recommendations would lead to NIE actions involving procurement, non-procurement and internal NIE behaviors in relation to the whole range of possible purposes. Then, in turn, the effects of these behaviors would be analyzed.

The scenarios are intended to suggest an analytical approach we view as appropriate for internal Agency use in designing procurements and relating procurement strategies to other, possible non-procurement courses of action. The strength of this approach, we would argue, is the manner in which it orients Agency personnel toward system-level thinking:

1. It requires the analyst to think in terms of the multiplicity of purposes implicit in procurements and other Agency behaviors, and suggests the legitimacy of designing courses of action in terms of latent as well as manifest purposes.
2. It requires consideration of interaction effects among purposes, between purposes and mechanisms, and between

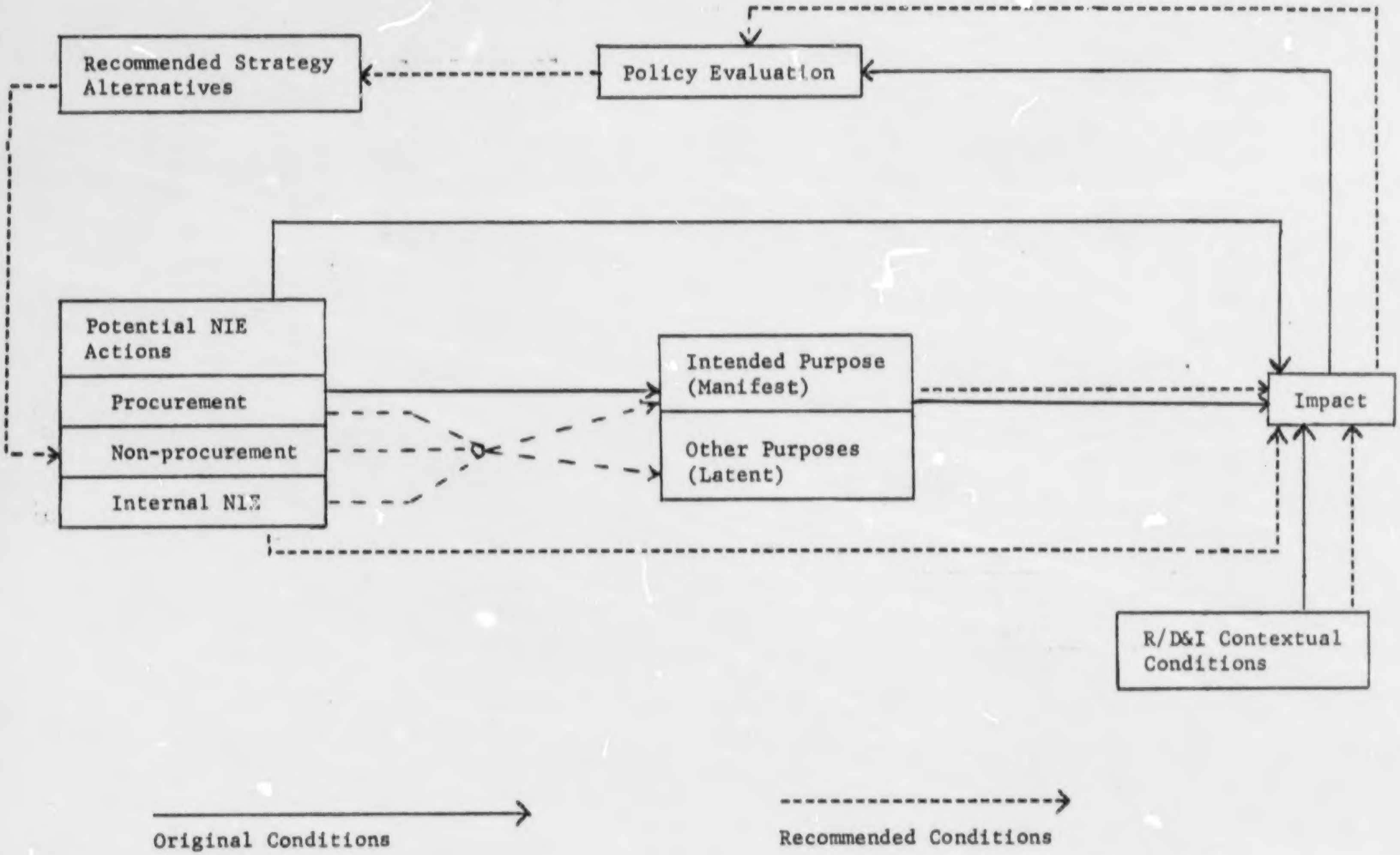

Recommended Strategy Alternatives
Policy Evaluation
Potential NIE Actions
Procurement
Non-procurement
Internal NIE
Intended Purpose (Manifest)
Other Purposes (Latent)
Impact
R/D&I Contextual Conditions
Original Conditions
Recommended Conditions

Figure 3: Scenario Analysis

purposes and generic characteristics of R/D&I functions as these are mediated by systemic and environmental conditions.

3. It calls for Agency personnel to estimate potential impacts of contemplated courses of action on key dimensions of the system.
4. It suggests a series of questions that enable the analyst to generate alternative courses of action with potentially different impacts, and to use these alternatives, along with their own estimates of potential impacts, to reformulate and refine contemplated strategies.

We offer the analysis which follows as a first-cut at what we believe can evolve over time into a highly useful approach.

REFERENCES

Duffy et al., 1976.
We had access to several internal memos, in various states of their development, in August and September 1976, including: a) an August 2, 1976 memo written by Susan Duffy and Noël Brennan entitled "Status Report on FIS"; and b) a somewhat later set of materials providing working definitions of Narrow and Broad FIS, elaborating the relevant dimensions of each, and considering some of the implications for NIE.

RESEARCH

RESEARCH

BASIC RESEARCH: KNOWLEDGE FOR ITS OWN SAKE

I. GENERIC CHARACTERISTICS OF BASIC RESEARCH

1. Uncertainty and Unpredictability
2. Time Frame for Outputs
3. The Rate at which a Basic Research Area can be Built Up
4. Some Other Fundamental Issues
    - A. The Criterion of Excellence
    - B. Competing Centers of Excellence
    - C. "Minimum Critical Mass"

II. BASIC RESEARCH IN EDUCATION

1. Weakness of Central Core of Educational Researchers
2. General Climate
3. The Interdisciplinarity of Education
4. The Funding Sources for Educational Research

III. IMPLICATIONS FOR THE ROLE OF NIE

1. Procurement Behavior
    - A. Facilitate Orchestration
    - B. System Building
    - C. Implications of Levels of Consensus in a Field
    - D. Process Mode of Management

2. Considerations Internal to NIE and Non-Procurement Activities
    - A. NIE Staffing
    - B. Non-Procurement Activities
    - C. Relationship between NIE, Staffing, Non-Procurement Activities, and a Wider Range of Procurement Options

PROBLEM-FOCUSED RESEARCH

I. GENERIC CHARACTERISTICS OF PROBLEM-FOCUSED RESEARCH

1. Introduction
2. Users and Funders: Seeing Problem-Focused Research as a Development Activity
3. Problems from the Perspective of the Researcher
4. The User's Role
5. Issues Related to the Characteristics of Peronnel Involved in the Problem-Focused Research Process
    - A. Large-Scale Research and the Response to the Required Institutional Setting

        - B. Redefinition of Studies into a Basic Research Mode
        - C. Problems in Maintaining the Interdisciplinary Focus
    - 6. Summary

II. THE EDUCATIONAL CONTEXT OF PROBLEM-FOCUSED RESEARCH

- 1. Basic Weaknesses
- 2. Institutional Bases
    - A. The Universities
        - 1. Scaling Down the Problem
        - 2. The Ad-Hoc Approach
    - B. Large R&D Organizations in the Private and Quasi-Sectors
- 3. Some Additional Considerations
    - A. Communications
    - B. Commitment
    - C. Climate
    - D. Need Identification

III. IMPLICATIONS FOR THE ROLE OF NIE

- 1. Procurement Behavior
    - A. Orchestration
    - B. System Building
    - C. Process Mode of Management
- 2. Considerations Internal to NIE and Non-Procurement Activities
    - A. Staffing
    - B. Internal Agency Structure
    - C. Non-Procurement Activities

RESEARCH

Research can be viewed as being essentially of two types:

1. Basic Research: Research to produce knowledge for its own sake.
2. Problem-Focused Research: Research seeking to produce knowledge applicable to the solution of a specified problem (commonly known as Applied Research).

In this section, we will examine Basic Research. In the next section, we will examine Problem-Focused Research.

BASIC RESEARCH: KNOWLEDGE FOR ITS OWN SAKE

I. GENERIC CHARACTERISTICS OF BASIC RESEARCH

The characteristics of Basic Research have been well and frequently discussed in the literature. We will here attempt only to highlight briefly and call attention to some of the particular characteristics that are of some importance to this analysis and which bear repeating by way of introduction.

1. Uncertainty and Unpredictability

The primary characteristic of Basic Research is its uncertainty and unpredictability. For example:

1. It is very difficult to predict the form, the type, the timing of outputs--or even of the inputs that will be required.
2. In the long run, what are later seen as the "most important" benefits of Basic Research were not even initially visualized, but rather resulted from spin-offs of the Basic Research or from findings that arose in unexpected and unplanned-for turns and byways in the Research process.
3. Indeed, the very definition or specification of what constitutes

a "Field of Research" tends to change over time.

A discussion of the uncertainty and unpredictability of Basic Research could be continued for some length. What is important here is to recognize some potential implications for NIE.

1. The Basic Research process calls for a high degree of creativity from Research personnel. The specific implications of this fact will become more obvious later in our discussions where the personnel involved are a significant consideration (e.g., in determining a "minimum critical mass" of talent).
2. Long-range program planning is essentially meaningless on a project-by-project basis. Most particularly, it seems difficult if not impossible to program the kinds of sudden, major "breakthroughs" that are sometimes sought. Indeed, in some fields or in some projects, such "breakthroughs" may never occur. Rather, progress may be incremental, developing through an accumulation and extension of knowledge over extended periods of time.
3. Since it is relatively difficult to know where and when useful outputs will occur, the primary need in Basic Research is for as much high quality activity as possible.
4. It is important to be sensitive to what is happening in a field and how a field is changing, as contrasted to thinking in terms of programming the changes in a field.

2. Time Frame for Outputs

Basic Research has both a short-term and a long-term frame. In the short term, the result of Basic Research is essentially to increase the total base of knowledge, i.e., to produce knowledge that is in turn used and built upon by other Basic Researchers. It is generally only over very long periods of time (e.g., 50 years) that the Basic Research results in practical application. Thus, what is done in the present, is done for the future. What is lacking in the present is a result of omissions of the past.

3. The Rate at Which a Basic Research Area can be Built Up

Two points must be made about the process of "building up" a high quality Basic Research area. First, a high quality Basic Research area cannot be built up very quickly. The cumulative development of a total base of knowledge is generally a long-term process (as we have just noted). And it takes a considerable amount of time to both train competent Researchers and develop a community of Researchers who are committed to a particular field.

Secondly, the rate at which a Basic Research area can be developed is dependent upon the number of competent Researchers and centers of excellence already existing in the field. If there are only a few competent Researchers and centers of excellence, the rate at which the total base of knowledge can be expanded is rather significantly limited. The training of new personnel who are committed to the field must be done by the currently available leading Researchers within the context of existing centers of excellence. Thus, the fewer such centers of excellence, the slower will be the rate of increase in the total number of competent, committed Researchers.

The above considerations have some significant implications for the funding in a Basic Research area. When the existing quality Research base is small, pumping large amounts of money into Basic Research would tend to have very little constructive or meaningful impact in either the short term or the long term. Instead, the impact would tend to be the generation of a large amount of lesser quality activity, much of which would simply be unproductive and would disappear (for lack of commitment) when the funding was withdrawn.

Beyond the setting of some upper and lower boundaries, there are virtually no useful guidelines for determining the "optimal" level of funding for Basic Research. Rather, funding becomes essentially a matter of faith related to the availability of funding. It is not even very helpful to make analogies to other fields because:

1. These other examples were themselves based on this kind of faith and/or historical extension.
2. The existing situation and opportunities can vary so dramatically as to make projections very difficult.

An upper boundary for funding would be determined by the rate at which funds can be usefully absorbed by the existing centers of excellence--i.e., the rate at which they could increase the number of graduate students and/or take on additional Basic Research programs. The lower boundary for funding might be determined by the minimal funding necessary to protect the existing centers of excellence (or, if necessary, to create such centers). In setting both the upper and lower boundaries, consideration should also be given to funding being provided by other funding sources (e.g., other federal agencies, foundations).

Between the upper and lower boundaries, there would tend to be a rather wide range of levels at which funding could potentially have significant impact. It should also be noted, of course, that these upper and lower boundaries might (for practical purposes) be further constrained by economic, political or other non-Research considerations.

4. Some Other Fundamental Issues

A. The Criterion of Excellence

The criterion of Excellence is central and predominant as a basis for decision making. Ideally, at least, Excellence is the key selection criterion for programs and projects to be supported, funded, or even permitted to take place (e.g., by allowing access to scarce facilities, etc.), and for the support of institutions and personnel.

B. Competing Centers of Excellence

However, where a Basic-Research field is relatively immature--where it lacks cohesion and consensus on the definition of Research areas, clarity on the standards that define Excellence, a well developed social structure that establishes a picture of who the field regards as authoritative, etc.--the choice among those centers of excellence that do exist becomes that much more difficult. Under these circumstances, funding agencies are faced with a choice of:

a. spreading resources around to many centers of excllence; or
b. "placing their bets" on a limited number of such centers.

C. "Minimum Critical Mass"

The resolution of choice among competing centers of excellence requires (at least) the introduction of another premise concerning Basic Research--namely the need to maintain a "minimum critical mass" of effort. This premise holds that because of the uncertainty and unpredictability in Basic Research, because of the need for a creative interplay between a number of persons with different perspectives (sometimes disciplines, etc.), and because Basic Research is a "building upon," generally incremental process, there must often be a certain "critical minimum" number of Researchers interacting with each other if Basic Research is to be productive within a given time frame. This minimum critical mass may vary across fields and is most particularly applicable to empirically based work. Observations of prior successful patterns can permit some estimations to be made.

Taking together consideration of limited funding, the existence of several competing centers of excellence and some notions of minimum critical mass, a funding agency might consider a strategy of "placing bets" on a limited number of centers of excellence as being superior to spreading its limited funds around to many centers of excellence.

5. A Possible Set of Selection Criteria

Summarizing from a number of points in the discussion thus far, we suggest the following as a possible set of criteria for selecting Research areas for funding:

1. Which disciplines (or sub-disciplines) have a potential for making a contribution in the long run?
2. Which areas are already being well-supported by the Agency or by other funding sources?
3. Which areas have the sufficient seeds of excellence to build upon?

After having made a determination of these first three criteria, then a fourth criterion may be added:

4. Which of the areas have the best potential for building long term capability for the Basic Research function?

II. BASIC RESEARCH IN EDUCATION

1. Weakness of Central Core of Educational Researchers

The central core of Basic Researchers, those committed to and devoting the bulk of their careers to educational Research, seems to be particularly weak in this field, especially when compared to Basic Research in most other fields. In education, this core group tends for the most part to be located in schools of education, in departments focused on each of a number of derivative disciplines (e.g., educational psychology, educational sociology). Consideration of these settings as the primary institutional bases for Basic Research in education suggests that there are relatively few centers of excellence and a great deal of mediocrity. Also, when one makes the distinction between numbers staffing these departments and numbers carrying out significant amounts of Basic Research, the relatively small size of this core, and its scattered condition, become apparent.

A somewhat different picture emerges when one examines Basic Research relevant to education carried out in discipline-based university departments (e.g., departments of Psychology or Sociology).

Here, there is considerable Excellence, and these disciplines often provide valuable inputs and contributions to the education knowledge and technology base. The problem, however, is that the commitment of discipline-based Researchers to the field of education tends to be variable and shifting over time. After all, their primary commitment is to their discipline, and education takes a secondary role.

Taken together, these two conditions create an educational Research community that tends to be unstable and amorphous, thus complicating the problem of relationships and of maintaining communication flows among the parts of the system. What this implies for NIE is a major system-building need in order to (a) create the vital, stable core of high quality Researchers and (b) facilitate and sustain interdisciplinary communication and collaboration.

2. General Climate

The general climate surrounding Basic Research in education has not been supportive. Basic Research in the social sciences is not held in high repute by the public or its representatives in Congress. In education the problem is intensified by the difficulty even Researchers have in pointing to more than a handful of significant developments that are traceable to Basic Research in the field. The consequence has been low prestige--complicating efforts to attract strong Research talent to the field--and low political support, unreliable funding, and lack of continuity in funding emphases--complicating the problem of sustaining the work of those strong Researchers who have been attracted to the field. Such conditions, then, have tended to limit the quality of relationships between NIE and the Researchers, and have acted as a constraint on building the needed central core of educational Researchers.

3. The Interdisciplinarity of Education

Educational Research tends to require an interdisciplinary attack, yet much of educational Research tends to be discipline-focused. This issue adds to the difficulty of developing and finding consensus and hampers communication between the sub-groups in the field. Further, the communication mechanisms in educational Basic Research are very diffuse. Lacking for the most part are either the invisible colleges or core journal mechanisms that typically structure information flow in other Basic Research field and would simplify information searches across discipline lines. The relevant journals, both those from the disciplines and those within education, are so numerous and so inadequately abstracted that the cumulative development of a relevant interdisciplinary knowledge and technology base seems difficult to envision unless a lead agency such as NIE intervenes and takes some facilitative actions.

4. The Funding Sources for Education Research

Given the multi-disciplinary nature of educational Research, and the rather substantial number of relevant disciplines, the single most prominent policy-relevant feature of the funding of Basic Research in education would seem to be the existence and use of multiple funding sources. Looked at in total, NIE's potential contribution in dollar terms is relatively small. This fact puts a premium on the requirement for NIE to be aware of and stay in close touch with the various sources that do provide funding for areas of work relevant to education. In this way, NIE can effectively use its resources through strategies of gap-filling, attempts to pool and coordinate resources across agencies, etc. And given NIE's position as the lead agency for educational Research and Development, this leadership/coordination role seems central to its mission.

III. IMPLICATIONS FOR THE ROLE OF NIE

1. Procurement Behavior

A. Facilitative Orchestration

Given the conditions we have been considering, the role of

NIE would clearly seem to be to orchestrate the various elements in the system. However, in contrast to the kind of orchestration we will describe later for the Development function, in Basic Research the kind of orchestration that would seem most appropriate would need to take place through a combination of:

1. facilitating the quality activities that are already existing in the field (i.e. seek out and support Excellence);
2. selecting the Research areas with which to work; and
3. being responsive to the shifts and changes that are developing in the field.

Such a strategy of facilitative orchestration would require a close NIE relationship with the field--ongoing, one-to-one relationships between Agency staff and Basic Researchers in the field. This kind of orchestration cannot really be achieved through the use of advisory panels representing the diverse perspectives of the Basic Research community, even the more creative use of long-term panels for shaping and monitoring broad programs. Facilitative orchestration requires certain kinds of internal staffing in the Agency and a collaborative mode of Research management that this kind of staffing makes possible. We shall return to these points shortly.

B. System Building

We have emphasized throughout our analysis the need for NIE to play a system-building role in managing its Basic Research program. We have suggested at several points that a key criterion in considering contemplated Agency actions with regard to this function should be estimating likely consequences for the development of long-term Basic Research capability--a building process that requires lengthy time spans and is constrained by the scale and state of development of existing centers of excellence. If NIE accepts this role, then in project selection this might mean accepting the legitimacy of latent system-building purposes in procurement, and recognizing that the system-building consequences of a given project are likely to be of greater importance than the project itself or its anticipated substantive output. Once an agency accepts a system-building role, and is operating in a function such as Basic Research where system-building activities cannot be planned or carried out independent of the field and Agency actions can be of only the facilitative/collaborative type if they are to be productive, then the Field-Initiated vs. NIE-Directed issue loses its meaning and forces consideration of a broader and more complex array of options.

C. Implications of Levels of Consensus in a Field

Different Basic Research areas are likely to vary in levels of consensus among Researchers in the field--as to key questions in need of answers, adequacy or appropriateness of different methodologies, etc. Under conditions of low consensus, the role of a funding agency would seem to be to work with the field rather than be directed by it--be fairly active in molding and selecting from what the field has to offer rather than just responding to scattered field-initiated proposals. On the other hand, under conditions of high consensus, such activity on the part of the Agency would seem to be less necessary. Thus, the Agency could operate in a mode in which one was responsive to field initiations. This perspective is somewhat different from that presented by the Duffy *et al*. 1976 memos. It is also worth noting in comparison to the Duffy *et al*. memos that under conditions of high consensus there would not seem to be the need for RFPs that seemed to be suggested there.

D. Process Mode of Management

Up to this point, we have focused our attention on the early stages of Agency management of Basic Research, i.e., the selection of Research areas, institutions, and projects to fund. We have not as yet considered how an agency monitors and manages components of its Basic Research programs after these selection decisions have been made. A few comments would seem to be in order here.

Given the unpredictability and uncertainty inherent in the Research process, tight monitoring of Basic Research programs in accord with predetermined output specifications is clearly infeasible. A more reasonable alternative than tight managêment of the Research product would seem to be monitoring of the Research process. However, given the nature of Research and especially of Basic Researchers, bureaucratic controls of the Research process would hardly seem to be in order. Instead, the problem resolves itself if the Agency has an internal Basic Research staff that is itself involved in Research and is functioning as an integral part of the field. Under such circumstances, NIE becomes part of the quality control mechanisms operative in the field, and may be acting both to insure the needed degree of quality control on given pieces of work while also stimulating the field's development of self-controlling mechanisms that make an Agency role in quality control less and less relevant over time as the system matures.

2. Considerations Internal to NIE and Non-Procurement Activities

A. NIE Staffing

The procurement behaviors we have been considering--facilitative orchestration, system building, and process management--all require the kind of close NIE relationship with the field that suggests a rather particular type of NIE staffing. Specifically what is implied is staffing an Institute Basic Research unit with personnel who possess considerable substantive competence in the Research areas with which they might be working.

It suggests too that these NIE Research personnel might themselves be involved in the Research process. This would seem to be vital if such personnel were to be sensitive to the shifts and revolutions taking place in the field and to be able to discriminate substantive advances and quality as compared to abberent shifts and poor quality.

Given those circumstances, it is quite likely that the skills, experience and interests of NIE personnel would strongly influence NIE decisions about which Research areas NIE would fund or support. While this might be of some concern, it need not be considered a major problem. Given the large number of potentially relevant Research areas, and the virtual impossibility of determining which of these are most likely to be productive for the future, there is no "right" answer to which Basic Research areas an agency such as NIE should support. There is no reason why an agency should not be opportunistic in selecting areas to support--taking advantage of the capabilities of its personnel, and permitting them to work with the field in the Research areas: (a) in which they find the most that interests and excites them, the most of what they view as productive work going on; and (b) those Research areas they are most strongly qualified to work with (and in) themselves.

What we are suggesting here is the need for NIE's Basic Research programs to be staffed by personnel who are themselves highly competent Researchers in any of a number of Basic Research areas of relevance to education. And further, we are proposing reviving the idea initially included in NIE's structure and operations in the form of its Basic Studies unit--the notion that NIE should support an in-house Basic Research capability--not so much because of the Research they will carry out per se, but because of the manner in which this could permit NIE to have a totally different relationship to the field.

NIE Basic Research personnel, under these conditions, would likely have an intimate knowledge of a number of relevant Research areas and the Researchers who carry out the work in those areas--who they are, what they are doing, what they have done in the past, what approaches they use, what parts of the relevant knowledge/technology base of the field they draw on. They would know how to use the informal communication mechanisms of a Research area, or where and how NIE should start in any contemplated efforts to facilitate the development of invisible college mechanisms or other informal communication channels. And equally important, they would have a very clear sense of whatever standards exist for judging Excellence, and too, have a sense of the sorts of questions to be considered in judging Excellence or in putting panels together to guide such judgments.

Perhaps most critical of all, with such personnel on NIE's staff, the NIE vs. Field issue would lose much of its meaning. Rather than NIE and the field confronting one another as discrete entities with often different interests, the boundary lines between the two would be more difficult to define and NIE could more adequately function as not simply an agency responsive to the field but as (in fact) an integral part of the field.

How can an agency such as NIE attract the kind of Basic Research talent we have been suggesting is needed? The problem is by no means a simple one. On the one hand, the Agency wants to attract strong Research talent. But it is unlikely that such personnel would be willing to leave Research settings for Agency positions for more than short stints (unless, of course, NIE could provide an attractive Research environment that could both attract and hold such talent--a strong argument in favor of inhouse Basic Research units). On the other hand, long-term commitments to the Agency would seem essential if the familiarity built up in working with Researchers in a given area is to have long-range utility for the Agency. A certain amount of interinstitutional mobility may be inevitable, and given that, perhaps could even be capitalized on, e.g., by developing exchange programs for two-way flows of personnel between the Agency and the field, with exchanges entailing long-term roles with inherent continuity regardless of the institutional affiliation of an individual at a particular point in time. Joint appointments and collaborative Research are other possibilities. We offer these as merely illustrative options. Our basic point is that such seemingly internal Agency matters as staffing have significant implications across the whole range of Agency actions, and may severely constrain Agency options.

One point of caution should be underscored about the kinds of personnel NIE should and should not have carrying out these activities. We would caution strongly against the kind of very independent "stars" of the field who are likely to distort the field to their own image of where the field should be rather than facilitating and working with the field. This does not mean that there are not some kinds of "stars" who are also good facilitators and collaborators. Rather, we are emphasizing the danger of selecting the kind of "star" who would tend to pull the field only into his or her own image, and would thus tend not to be sensitive to and supportive of other areas of significant activity. It is important to recognize that there is a considerable difference between the role (and hence the kind of personnel) needed in a Research institute that is concerned primarily with conducting Basic Research and the rather different role needed in a coordinating funding agency that is promoting Basic Research, as is the case for NIE.

B. Non-Procurement Activities

If NIE had the kind of staffing we have been considering, the Institute could carry out a number of critical non-procurement activities vital to its leadership role in an immature system.

At the very least we would expect such NIE personnel to carry out such activities as: conducting Research of their own, perhaps in collaboration with Researchers in the field; developing very clear notions of what quality work is going on, and how it could be facilitated; spending a fair amount of time travelling to stay in touch with people in the field, and remaining in touch informally by telephone, etc.; attending or even sponsoring conferences and seminars; working with professional associations; and perhaps even facilitating the development of invisible colleges and various other communication and quality control mechanisms so essential to the cumulative development of high quality knowledge/technology bases.

Beyond this, NIE personnel might well carry out such critical tasks as: mapping Research areas; providing critical syntheses of the state of the relevant knowledge and technology bases; reviewing what work is currently going on where, what approaches are being used, how these relate to state-of-the-art needs and what kinds of work still need to be done, what opportunities exist for what kinds of talent, etc.; etc. The preparation of such annual review documents would necessitate close NIE staff interaction and communication with the field, and could easily be the wedge that would enable the field to see NIE as an integral part of its functioning and a critical facilitator of its development. But only, of course, if these reviews suggested thinking reasonably congruent with the best thinking in the field--again suggesting the need for close collaboration in the development of such reviews.

Such reviews can serve a number of purposes, not the least important of which might be use as a mechanism for attracting strong Research talent in certain areas. If such reviews were distributed widely, and were sent especially to a carefully selected list of capable Researchers whom one might want to attract to work in the field of education, the recruitment and capacity-building potential of such mechanisms might be considerable.

This suggests a non-procurement behavior the Agency might consider, with considerable long-range implications for procurements as well as other aspects of Agency action. This is by no means an original idea--NSF has been doing this with some success for years.

Mention of NSF points to one additional kind of non-procurement activity NIE should be engaged in--i.e., working to bring about some degree of coordination among the various governmental and private (e.g., foundations) sources of funding for Basic Research relevant to education. NIE might use its position as lead agency for Research and Development in education: a) to develop communication channels among funding sources; b) to develop analyses of the cross-agency funding pattern (e.g., where there are areas of overlap, where there may be gaps); and c) to suggest opportunities for pooling of resources where the potential for synergy among projects may exist and/or where such pooling of resources would seem to increase the likelihood of greater overall impact.

C. Relationship between NIE Staffing, Non-Procurement Activities, and a Wider Range of Procurement Options

To illustrate how the kind of staffing we have been considering and the types of non-procurement activities this staffing makes possible can impact on Agency procurement options, we borrow another example from NSF. If staffed with personnel having the proper credentials, we could envision NIE pursuing an interactive relationship with the field. An Agency staff member might carry out a number of intensive discussions over a certain period of time with some of the strong Research talent that exists within the field or in other relevant areas. These discussions might focus on the kinds of work seen as needed, the state of the art for carrying out such work, and what portion of all this a particular Researcher would want his own organization to carry out. At some point along the way, some of these Researchers might be approached to prepare brief statements--the outlines of thinking oriented in the direction of formal proposals. (Or such initial statements might be derived from unsolicited proposals received by the Agency.) This brief statement might be the beginning of a lengthier cycle of communication and interaction focused on collaborative development of proposals that reflected the thinking and interests of both the Agency and the Researcher(s). The Agency role here would be largely facilitative. The NIE staffer might suggest that the Researcher get in touch with a particular organization that is doing some thinking along similar lines, or might suggest that the proposal could be strengthened or made more attractive for funding if this or that were changed in this or that manner. After several such cycles, with perhaps a certain amount of involvement of the broader field as well as the particular Researcher and staff member, some rather exciting and strong plans might evolve, rather different from what would instead have been proposed without this interactive, collaborative relationship between NIE staff and the Research community. We include this example simply to be illustrative of the range of options available for funding Basic Research, options rather different in nature from dependence on the unsolicited proposal or grants competition mechanisms--with rather different implications for the manner in which NIE relates to the field.

We recognize that the pattern of Agency/Field relationships we are offering here for NIE consideration runs counter to strongly held feelings in government circles about the need for "fairness"--the need to treat all potential contractors and grant recipients alike, without giving undue advantage to one or another individual or organization. However, we would argue that many of these convictions about "fairness" and "equal treatment" for potential contractors may be more appropriate to mature systems, and inappropriate to Agency behavior in relation to immature R/D&I systems. If NIE is to take seriously its legislative mandate to "build an effective R&D system" in the education sector, system-building considerations may have to be given precedence over other principles of Agency behavior--especially when those principles may be inappropriate for the particular context in which the Agency must function. We suggest that these matters need careful consideration in relation to the rather fundamental kinds of questions we are raising about NIE's mission and role vis à vis the field with which it works.

PROBLEM-FOCUSED RESEARCH

I. GENERIC CHARACTERISTICS OF PROBLEM-FOCUSED RESEARCH

1. Introduction

Problem-Focused Research has two basic characteristics--and herein lies an inherent problem.

1. Problem-Focused Research is Research.
2. But Problem-Focused Research is "targetted"--i.e., there is a very specific area of focus. Thus Problem-Focused Research seems like Development.

From the above, we can see that Problem-Focused Research can be deceptive--it looks both like Basic Research and like Development. It has elements of both; yet it is neither. Thus, the inherent tensions between Basic Research and Development are inherent in the Problem-Focused Research process. And this tends to lead predictably to certain kinds of problems.

The basic tension is that:

1. On the one hand, Researchers tend to treat Problem-Focused Research in a Basic Research mode.
2. On the other hand, Users and Funders tend to treat Problem-Focused Research as if it were a Development activity.

For the funding agency, some important issues arise from this basic tension. The tendency of Researchers to use a Basic Research mode even while conducting Problem-Focused Research may imply the need for some sort of monitoring role from the funding agency. But this would be a difficult role for an agency to carry out because of the unpredictability involved even in Problem-Focused Research.

Perhaps even more importantly, the funding agency will have to resist its own temptation to treat Problem-Focused Research as though it were a Development process. Development permits a greater degree of specificity and so of Agency controlling activity. The point here is that different--not similar--control mechanisms and strategies are applicable because Development and Problem-Focused Research are dissimilar.

2. Users and Funders: Seeing Problem-Focused Research as a Development Activity

It is to be expected that Users would tend to see Problem-Focused Research as a Development activity. After all, their concern is with the development of a product they can use. Perhaps to a lesser extent, we would also expect Funders to have a similar perspective, especially given the fact that Researchers often oversell their efforts and the potential immediacy of the benefits as a strategy to obtain funding.

Several problems tend to arise when Users and Funders think of Problem-Focused Research as a Development activity.

1. In Development activities, there are specified "targets" which are relatively fixed. However, simply because Problem-Focused Research is Research, the "targets" tend to be unstable. What starts as a Problem-Focused Research project may gravitate towards a Basic Research project (or vice versa).

   Because Users and Funders have a Development perspective (which assumes a stable or fixed "target"), the shifting of "targets" in the Problem-Focused Research process easily leads to frustration by Users and Funders.

2. Like any Research activity, Problem-Focused Research has a high degree of uncertainty and unpredictability in relationship to time horizons, costs, etc. Again, this tends to be less so for Development activities.

   When we consider the uncertainty and the instability of "targets," we can understand that the RFP-type of mechanism is really inappropriate for Problem-Focused Research. The RFP mechanism, with its specificity, creates an inevitable tension situation, forcing the Researchers to play games.

The Researchers will tend to oversell, to predict what they cannot predict in advance, to suggest they will produce something about which they are uncertain. Once having been funded, the Researchers are likely to find they are producing something very different (or that they are working in a very different direction) from what the RFP specified. Thus, the Researchers face a constant choice between the "lesser of two evils": either (a) decline the funding because they cannot be sure they can meet the RFP specifications; or (b) respond to the RFP and play games with the funding agency.

3. Problem-Focused Research is performed by Researchers who behave like Researchers rather than like Development personnel. For example, while Development personnel continually have to face such requirements as specified timelines, Researchers are not accustomed to being subjected to such requirements, and will thus tend to ignore and/or resent these "Development type" requirements.
4. In the Need Identification/Problem Definition process, there is a real gulf between the Research and Development perspectives--and thus between the perspectives of Researchers, on the one hand, and Users and Funders, on the other.

   Users and Funders will tend to focus on the practical problem immediately at hand. Their concern will be: "What is going to solve this problem?" Contrarily, the User/Funder concern may or may not be seen as important by the Researcher. The Researcher will be concerned with identifying a researchable problem--which may or may not be the same as the problem identified by Users or Funders.

   Even when the Researcher and the User/Funder are in agreement as to the *desirability* of a specific problem-focused target, the Researcher may see only one aspect of that problem as being *researchable*--and the Users and

> Funders may respond: "Yes, but that won't help us to solve our problem"; or, "Yes, but that would take too long."

The issue for the funding agency is the need to balance, on the one hand, the significance of the problem area as perceived by Users, and on the other hand, the extent to which that problem area is researchable, given the current state of the art. The tendency will generally be to put too much weight on the significance of the problem area and the practical (end-result) justification for beginning a Research program, and to give inadequate attention to the extent to which the Researcher could likely come up with anything useful at this time, or researched in this way, or researched in a certain time period. Probably the worst of all situations is to have very bad Research being done on a very important problem.

The nature of Problem-Focused Research is such that the User does have a significant role in defining the overall context for the Research--i.e., in identifying and defining the practical (User) need on which the Research is to be focused. However, the User's role must be kept in perspective. The User cannot determine what is in fact researchable, within what time frame, etc. Thus, the funding agency has the role of:

1. orchestrating the tension between User and Researcher perspectives; and
2. not undertaking program Research in areas that (for whatever reasons) cannot be usefully researched.

3. Problems from the Perspective of the Researcher

Switching now to the perspective of the Researcher, we find that several more problems may be likely to arise because of the Researcher's tendency toward a Basic Research rather than a Problem-Focused Research mode.

1. Problem-Focused Research tends to require a scale and cost of efforts which is significantly greater than that of the

Basic Research mode to which the Researcher is likely to be accustomed. This larger scale of effort tends to result from the fact that in comparison to Basic Research, Problem-Focused Research:

a) usually requires significantly more empirical investigation (either laboratory or field study);

b) tends to require more usage of large and possibly interdisciplinary teams.

What rather naturally tends to happen is that the Researcher subsumes or redefines Problem-Focused Research issues into Basic Research issues which can be handled within a smaller scale of efforts.

2. Similarly, the Problem-Focused Research project typically needs to be done in some sort of large scale (somewhat bureaucratic) institutional complex (such as a Research institution, a Research laboratory) where larger scale, longer-term efforts can be made and continuity maintained. Again, this is a mode which is not typical of Basic Research.

3. For several reasons, quality control tends to be far more of a problem in Problem-Focused Research than in Basic Research.

a) For one thing, there are fewer and less effective control mechanisms. While we can find similar controls in relation to Problem-Focused Research, here the controls tend to be far more limited in number, scope, visibility and effectiveness. Since self quality control of the field is weaker, the funding agency will here have to initiate and control the use of panels of people in the Research field. A major agency concern will be getting the right people together for these panels. Where there is a relatively weak Research community, the same persons will tend to be over-used, thus creating problems of bias and narrowness of focus. Further, since Problem-Focused Research tends to be multi-disciplinary, various groups can form around specific problems and self define the criteria of "quality", in which case, relevant interdisciplinary control mechanisms may not exist and may be needed.

b) When Problem-Focused Research is interdisciplinary, each discipline will likely have different perspectives and conclusions as to problem definition, criteria for "quality", and Research methodology. Thus, the very process of coalescing (and orchestrating) the different perspectives (and interests) into common agreement is itself a difficult process.

c) The problem of quality control becomes even more significant when viewed from the perspective of scale and magnitude. Because Problem-Focused Research is generally of a significantly greater scale or magnitude than Basic Research, the need for control in Problem-Focused Research is greater than in Basic Research--while the ability to control is less.

At this point, the funding agency faces a very frustrating dilemma. The substantial funding investment required by Problem-Focused Research calls for increased control of the process, but because this is Research, the Agency cannot be effective in trying to control the process bureaucratically. Thus, the primary means for an agency to control the process is to be part of the process--which in turn means having a significant internal Problem-Focused Research component. If an Agency had such a substantial Problem-Focused Research unit (or equivalent), these persons would be part of the self-regulating quality control mechanisms of the field. Instead of having bureaucratically imposed control, these Agency Researchers would be working with the field in creating some standard field mechanisms, the kind of mechanisms that provide quality control in the disciplines. Because Agency Researchers would be part of the process, the Agency would have a degree of control or involvement in the field's own quality control.

d) We may further note that because of the greater scale and cost of Problem-Focused Research as compared to Basic Research, funding agencies tend to be more involved in the quality control process. Inevitably, this has the effect of imposing more limits on the freedom of the Researcher. If however, this control were effected in the manner described above it might not be perceived as onerous.

4. The User's Role

Given the inherent tension between the Researcher and User perspectives in Problem-Focused Research, the need is apparent for some clarity in defining the appropriate role for the User in the Problem-Focused Research process. This would seem to call for differentiating appropriate User roles in two stages of the Problem-Focused Research process: The Need Identification/Problem Definition/Project Selection stage, and the Research stage.

1. In the Need Identification/Problem Definition/Project Selection stage, mechanisms are needed to allow significant User participation because:

a) The User need is, by definition, a significant parameter in determining the focus or "target" of Problem-Focused Research.

b) The Researcher would normally have somewhat different insights and perspectives from those of the User.

Thus, the purpose of User participation in this stage of the process is to provide the Researcher with the inputs he needs to have a good initial awareness and understanding of User needs from the *User's perspective*. We should be clear, however, that here the User role is *not* one of exercising veto power over project selection.

2. In the Research stage, however, a rather different User role would seem to be called for--one in which User participation is

minimal. Here, the premium is on creativeness in response to the identified need, and the Researcher is best left alone rather than influenced or controlled by possibly dysfunctional User pressures.

5. Issues Related to the Characteristics of Personnel Involved in the Problem-Focused Research Process

We are now ready to delineate several key issues facing the funding agency as a result of characteristics of the Research personnel involved in the Problem-Focused Research process.

A. Large Scale Research and the Response to the Required Institutional Setting

First, we must note that because a considerable amount of Problem-Focused Research tends to be large scale (or needs to be so carried out) and thus to be performed within an institutionalized base, the organizational context may be less than inviting for the Researcher. The extent of bureaucratic control of the Research process, and of such things as deadlines and programming of activities, is likely to be greater than that to which the Researcher is accustomed. Having been socialized in Basic Research contexts and positions, Researchers tend to resist this kind of controlling activity.

As a result, some of the better and more widely known and influential Researchers will tend to avoid Problem-Focused Research in preference to Basic Research.

Thus, the funding agency must recognize this dynamic and, if anything, bend over backwards to accommodate Researchers in order to keep them attracted to the Problem-Focused field (in contrast to what agencies sometimes seem to do).

B. Redefinition of Studies into a Basic Research Mode

Even when Researchers do get involved in Problem-Focused Research, they will rather naturally tend to bend the Research to the modes with which they are comfortable, i.e., to redefine Problem-Focused Research projects into Basic Research projects. They will be more likely to look for the Basic Research aspect of the Problem-Focused Research problem than to look at the Problem-Focused Research problem at hand.

Thus, the issue for the funding agency is to keep Researchers focused on Problem-Focused Research concerns rather than following their natural tendency toward Basic Research questions. The funding agency must keep one point clearly and sharply in focus: Problem-Focused Research is Research, but it is not Basic Research. Thus, a Research proposal should not be funded as if it were Problem-Focused Research if it lacks the proper focus--i.e., if the proposal focuses on Basic Research questions rather than on the kind of problem* appropriate to Problem-Focused Research. It might of course be worthy of funding as Basic Research--from funds allocated to that. Because of the tendency of Researchers to switch the focus, the funding agency must be sure it is leading (in consort with the Researcher) rather than being led blindly. Its role is active and proactive instead of passive and reactive. Otherwise funds will tend to be directed into Basic Research.

This is precisely the problem so often encountered in field-initiated work (especially work suggested by unsolicited proposals). The initiators are often Researchers who, as we are noting, tend toward Basic Research, especially the most creative of them and those whose efforts tend to be focused on outputs capable of being published in the more prestigious Research journals. The potential dangers increase when the Researchers making such proposals are the "stars" of a field. Such persons are often Basic-Research oriented, and being influential and prestigious, they tend to become field and focus defining, and their proposals are more likely to win approval. We must note here that this is not an issue of Excellence. The proposed research may be of excellent quality--it just may not be appropriately problem-focused.

---

*We are using "problem" here to refer to social problems or problems of practice, in contrast to the intellectual problems (i.e., Research problems, or problems inherent in the development of the knowledge base of a discipline) that structure Basic Research inquiries.

The funding agency must mediate the whole process, and this will require high quality personnel within the Agency.

C. Problems in Maintaining the Interdisciplinary Focus

Similarly, we must note that having been trained in a specific discipline, the Researcher will rather naturally tend to redefine problems into those that fit into the perspectives and boundaries of his own particular discipline--the discipline in which he works most comfortably.

It may be necessary to allow this to happen at least to some extent, because this is what is of interest to (and thus motivates) the Researcher. The trouble is that it is too easy for the Researcher to shift the focus of a problem in this way.

As a result, where a problem could be studied on an interdisciplinary basis, the interdisciplinary focus may be lost unless some kind of proactive tension is provided.

Thus, the issue for the funding agency is to provide mechanisms to maintain an interdisciplinary focus where possible, while at the same time being careful not to "overprogram" such an interdisciplinary focus. The most reasonable strategy for the funding agency in this instance is probably to include this interdisciplinary requirement as part of the evaluation process at the beginning--during the selection of projects, the selection of institutions, etc.--but not to interfere with the overall process itself.

The maintenance of an interdisciplinary focus is an objective most appropriately met during the selection stage; it is not likely to be accomplished effectively through attempting to impose process controls. In order to maintain an interdisciplinary focus, the funding agency has two alternative approaches to consider:

1. On the one hand, the Agency may choose to create an interdisciplinary setting in which the Research will be carried out. Here, the Agency must face the issue of whether or not it wishes to get into an institution-building mode.
2. On the other hand, the Agency may choose to allow the various different disciplines each to undertake the work in its own way and within its own boundaries. Here, the Agency faces the problem of "putting it all together--which may require additional projects, or the establishment of some other method of integration.

6. Summary

Inherent in the Problem-Focused Research process are two conflicting tendencies:

1. The tendency of Users and Funders to turn it into a Development process.
2. The tendency of Researchers to turn it into a Basic Research process.

A further complicating problem is the fact that the Researchers are not a cohesive group but rather belong to different disciplines, each with its own perspectives and boundaries.

The funding agency must be very clear as to the existence and nature of these conflicting forces.

In this light, the funding agency has several key roles:

1. to maintain the integrity of the Problem-Focused Research;
2. to mediate, balance, synthesize the conflicting forces inherent in the Problem-Focused Research process;
3. to insure that there is adequate input regarding the perspectives and needs of the various kinds of Users to which

the Research process is directed ;

4. to insure the participation of competent Researchers by presenting clearly and invitingly the Research aspects of the process which interest, excite and motivate them.

It should be clear by now that balancing the conflicting forces in a way that keeps Problem-Focused Research productive requires skillful orchestration by the funding agency personnel. It is also immediately obvious that if the funding agency is to be able to perform its orchestrating role effectively, it would seem advisable for the Agency to have very knowledgeable and skillful personnel on its staff--personnel who understand the forces and issues involved. As this is not always possible, an alternative that might be attempted would be to utilize such integrating mechanisms as panels, conferences, etc., where representatives of the Users and of the various disciplines of the Researchers can discuss the issues and reach consensus. However, we must recognize that the basic nature of the Problem-Focused Research process is for the different participants to be in tension with one another. Thus, just bringing them together does not solve the problem of conflict--it merely provides a way or mechanism for orchestrating a conflict sitution. As a result, even when provision is made for bringing the different participants together, there remains the need for in-house Agency people to perform skillfully the role of balancing, mediating, and orchestrating the conflicting forces.

In the way the funding agency attempts to procure programs and manage Research activities, there is really no substitute for having within the Agency knowledgeable and skilled personnel who are highly involved in the area of concern.

The generic characteristics of the Problem-Focused Research process are so important that we probably cannot overemphasize what Problem-Focused Research is and is not--and especially how it differs from Basic Research and Development.

From this perspective, we have already noted the following implications for Agency strategy:

1. The process cannot be controlled in a standard "bureaucratic" manner. Rather, an agency can best exercise control by being involved in the process.
2. The Agency must play a major leadership role rather than being blindly led by the Researchers. At the same time, Problem-Focused Research is not highly attractive to some of the most creative Researchers. Thus, while leading and controlling, the Agency must also be as accommodating as possible to the Researchers in those aspects that do not subvert or divert the primary intent of the program.
3. It follows that having knowledgeable professionals within the Agency is a very important part of a funding strategy.

II. THE EDUCATIONAL CONTEXT OF PROBLEM-FOCUSED RESEARCH

1. Basic Weaknesses

Probably the greater part of the Research that is carried on within the field of education is Research of the Problem-Focused type. There is a sizeable community of educational Researchers who carry out work that is problem-focused. And there is an enormous quantity of Research of this applied or problem-focused variety produced every year. Nonetheless, the field is basically a weak field:

1. Most of what is happening is small-scale, scattered, fragmented.
2. There are major questions about the quality of what is being done.
3. There is a lack of clear definition and identity of the field as somehow different from either Basic Research or Evaluation or Policy Research.
4. There is even a lack of clear delineation or consensus on the problem areas that structure this as a field of inquiry

or as an R/D&I function.

There is a considerable amount of confusion in education as to just what is and is not Research of an Applied or Problem-Focused nature. On one end of the inquiry continuum, one finds considerable difficult in education in distinguishing Applied or Problem-Focused Reearch from Basic Research. On the other end of the continuum, there is a tendency of many--generally non-Researchers--to confuse Applied or Problem-Focused Research with a broad range of other activities that cannot properly be subsumed under the Research rubric--e.g., library research (such as examination of alternative sets of teaching materials); demonstration projects (a favorite device for diverting "Research" funds into other uses); or the social bookkeeping kind of statistical record keeping that occupies the attention of so many school system "Research" offices.

One of the clearest indicators of the weaknesses and immaturity of the Problem-Focused Research field is the widespread inability of educational Researchers to define what is a researchable problem. In education, a great deal of what is defined as a problem is defined on the basis of the significance of the topic area rather than on the basis of what is researchable. Indeed, many of the proposals that are made are about questions having clear significance in terms of the substance of the problem. However, the simple fact that a significant social or practice-based problem is not itself a Research problem is something that does not appear to be completely understood in the field of education. The oft-noted criticism of the inability of educational Researchers to define reasonable Research problems comes about in part because there is a gap between Researchers' understanding of a given need or topic and how one would go about researching the need or even translating the general problem into a researchable problem. As a result, Problem-Focused Research in education is characterized by a tremendous amount of oversell. This is not because the people involved are charlatans, deliberately promising to answer questions they know they cannot answer. Rather, it is too often the case that the Researchers do not even know that the state of the art renders them incapable of answering questions which they have defined as a need or problem.

2. Institutional Bases

There are primarily two institutional bases where Problem-Focused Research is carried out in the field of education: the universities, and a number of large R&D organizations in the private and quasi-public sectors. There are problems inherent in both of these institutional bases.

A. The Universities

The universities have the capability to do Problem-Focused Research, but they tend to do it in a Basic Research mode--both because that is the mode the Researchers have been trained and socialized in, and because of the social pressures of the university as an institution. In a university setting, Researchers are rewarded for acting like Basic Researchers rather than for problem solving. Thus, Research gets bent into the Basic Research mode, especially if the Research is being done by a group within a particular discipline. A second point about universities is that they usually do not have a minimum critical mass of the capabilities needed to carry out Problem-Focused Research. The result tends to be that either (a) a problem that requires a large scale approach will tend to be scaled down to fit the resources that the university has available; or (b) as an alternative, the university will put together an ad-hoc group of people who tend not to stay together very long as a work group. Neither of these alternatives is really very helpful, but both are typical enough to warrant some further attention.

1. Scaling Down the Problem

If a university lacks adequate resources to deal with a problem that requires a large scale approach, the problem will tend to be redefined to a smaller, manageable scale. In particular, the time frame will tend to be reduced (as we shall note in more detail below). Additionally, in a university setting a problem is often approached by a group of Researchers from a specific discipline and, rather naturally, this group will scale the problem down to fit into the focus and capabilities of their own disciplines, thus veering the Research away from the problem focus to a disciplinary focus. In schools of education, where the problem focus is more likely to be maintained, a somewhat different kind of problem is encountered frequently. With the possible exception of the ten to fifteen schools of education in this country with strong Research traditions, schools of education generally lack the kind of well trained Research faculty and graduate students more likely to be found within the disciplinary departments. Typically, then, the university setting for Problem-Focused Research offers the funding agency a choice between well trained personnel who are likely to redefine Problem-Focused Research into Basic Research modes or adherence to the problem focus by Researchers less likely to produce quality work.

2. The Ad-Hoc Approach

Whether the reason be the disciplinary emphases of university personnel, the general fragmentation of the field, or whatever, it is the nature of the university social system that people will tend to come together for a while to work on a problem and then go their separate ways instead of staying together for a long period of time.

This ad-hoc, short term approach tends to be highly dysfunctional simply because Problem-Focused Research (and Research in general) tends to require longevity--i.e., the building of skill groups that can work together over long periods of time. The focus of the Research is problem solving, a process that takes time, especially if the need is to develop a long-range Problem-Focused Research program.

We may also note that the commitment to a set or series of concerns (which tends to exist in Basic Research in the disciplinary setting) tends more often than not to be missing in relation to Problem-Focused Research--a dynamic that reinforces the ad-hoc approach.

This tendency towards ad-hoc approaches bears further examination from the institution-building perspective. There may indeed be extremely well written proposals from a university group to do Research in a given area. There may even be a "star", a very competent Researcher with the appearance of a strong group around him (or her) to do the Research. Indeed, for providing good quality results from a particular piece of Research, this group may in fact appear to be a strongly qualified group, one that would do the work well.

However, it would seem essential for NIE to be concerned with long-term capacity and system building as well as with the particular results of a single Research project. Looked at from an overall system perspective, the procurement of a group that will be together only for one or maybe two projects will not be as relevant, meaningful or cost/effective (in the long term) as funding a group which has(or has the potential to develop) longevity. In the latter instance, the Agency would be procuring not only a short-term product but also a system-building capacity.

In summary, universities tend not to be able to put together long-term, large scale work groups. As a result they tend either to scale down a problem into one that is manageable with existing capabilities; or they develop ad-hoc, short-life groups for individual Research projects which add nothing of significance towards building overall system capabilities.

B. Large R&D Organizations in the Private and Quasi-Public Sectors

A somewhat different set of problems characterize Problem-Focused Research as this is carried out in large R&D organizations in the private sector (generally non-profit corporations and occasionally for-profit organizations) and in the quasi-public sector (the federally-created regional laboratories and R&D centers). These are organizations that, by their very nature, should be particularly well-suited to carrying out Problem-Focused Research. They are likely to develop and put together the resources for large scale Problem-Focused Research, particularly the larger organizations. They are likely to put together work teams that will stay together for a long time. There are not the internal social pressure that one gets in the university setting that would veer Researchers away from focusing on specified problems (even when these seem to provide no exciting and potentially publishable outputs).

However, at least two significant kinds of problems are discernible from the history of these organization. First, it is not obvious that there are attractive career paths in these organizations that are capable of attracting the best talent. A small handful of these organizations win a large number of contracts, and can offer people some degree of stability and the prospect of a long-term career. But, compared to a university (which is the setting that tends to attract most of the best Research talent), there is no similar kind of long-term tenure or commitment. The likelihood is that, for a variety of reasons, these organizations may have great difficulty attracting the strongest Research talents.

The second kind of problem may be an even more serious one. Many of these organizations were originally established to carry out Applied (i.e., Problem-Focused) Research as well as Development. However, the history of the labs and centers is suggestive of a pattern that is probably somewhat discernible in the private sector as well. By the later 60s, federal procurement emphases reshaped these organizations, especially the labs, into Development organizations rather than organizations that carried out the full spectrum of R/D&I activities including Problem-Focused Research. That is to say, most of the money tended to go for Development rather than Problem-Focused Research. Consequently, these organizations (being the type that are structurally responsive to funding sources) expanded their Development capacity more and more. To the extent they carried on Problem-Focused Research, it might have been as an inducement to keep some of their Research talent happy and to maintain them in the organization.

To summarize, there is one all-pervasive point that becomes apparent from examining the institutional bases of Problem-Focused Research in education: there is a fair amount of Problem-Focused Research around, but it tends to be discrete, small scale Research projects rather than very large-scale projects. Certainly there may be a significant number of Problem-Focused Research problems which can be tackled in a small way. But the ones that are probably the focus of NIE procurement tend to be larger-scale, complex programs that will likely require long-term Research capability.

The basic point is that there is very little large-scale, long-term Problem-Focused Research being done. The universities tend to scale it down or not do it in the long-term mode. The large institutes and organizations in the private and quasi-public sectors that are organizationally capable of putting together large scale long-term work teams tend to have been pushed into becoming primarily Development organizations. This may be overstating the case; but certainly they have not filled the need for a significant amount of large-scale, long-term Problem-Focused Research to meet needs.

It appears that Problem-Focused Research in education is essentially an area that needs to be put together--it it not really there now to any sizeable degree. In part this is because the field has tended to think in terms of Basic Research concepts, or Development concepts, rather than thinking of Problem-Focused Research as a fundamentally different kind of Research, requiring different sorts of structures and institutional bases which are suited to Problem-Focused Research as a distinct mode of R&D activity.

3. Some Additional Considerations

A. Communication

Problem-Focused Research shares many of the problems that we already noted about Basic Research. The information mechanisms and the communication structures of the field are inadequate--even more so than in Basic Research. Not only does the field lack invisible colleges,but there is an even weaker journal structure. Relatively few journals specialize in definable Problem-Focused Research areas, and material relevant to any particular problem area tends to be scattered among scores of journals. There are relatively few abstracting mechanisms in the educational field at all, and virtually no usable abstracting mechanism of relevance to any but a handful of problem areas. The whole information retrieval system, which might be potentially useful to the Problem-Focused Researcher, is really not geared to Problem-Focused Research.

B. Commitment

Given the way the field is currently organized, with the Problem-Focused Researchers constantly moving in an out of problem areas, commitments tend to be short-term rather than long-term. Thus informal communication mechanisms and personal information flows are difficult to sustain; the communication networks are even more diffuse than in Basic Research, where we have already noted the very rudimentary state of development of communications networks.

C. Climate

The climate surrounding Problem-Focused Research is even more negative than the climate surrounding Basic Research. The reason, quite simply, is that more tends to be expected of Problem-Focused Research, and therefore the disappointment is far greater when no payoff seems forthcoming. Basic Research does not hold out the promise of solving life's problems so saliently. Thus, there is a degree of acceptance when a specific Basic Research project does not produce answers--or may do so only in a distant future.

But, in contrast, precisely because it *is problem focused*, Problem-Focused Research does (rightly or wrongly) seem to hold out a "promise" to solve ongoing operational problems. Thus, when such rather costly Research projects do not produce answers (or might possibly do so only over a long period of time), there *is* disappointment. The result, inevitably, tends to be the generation of strongly held feelings that Problem-Focused Research is a waste of money.

D. Need Identification

A related point here has to do with Need Identification for Research--who does it, and how a whole set of problem areas have been identified. In the past, Need Identification has been Researcher-driven. That is to say, Researchers identified their own problems, with very little input from Users. Thus, the problems defined by the Researchers were things that interested them rather than necessarily the problems perceived by Users or by people affected by the problem. As a result, Researcher-defined problems turned out to be either so irrelevant, ill-defined or misperceived that the User community perceived the Research as useless.

Now it appears that there has been an overreaction to the predominance of Researcher-initiated inquiry into problems. Thus, the definition of problems is now perhaps overly system-driven. NIE is defining problems; Users are defining problems; and the Research community is doing a great deal of complaining about the fact that the problems which are being defined either are not problems that are researchable or are not problems that should be the focus of Research sponsorship.

Clearly, then, there is some need for orchestration in the Need Identification process. Given the current level of maturity in educational R/D&I as a whole and educational Problem-Focused Research in particular, only an agency such as NIE can provide the orchestration needed to maintain and mediate the existing tension, permitting the Researcher viewpoint to take on increasing influence as the capability of the Research community permits.

E. Funding

As in Basic Research, the sources for Problem-Focused Research funding are numerous. NIE, as the lead agency (even though not necessarily the major funding source), has a role in working with other agencies to orchestrate funding so that NIE funds can be applied in a way maximally useful to the system.

III. Implications for the Role of NIE

1. Procurement Behavior

A. Orchestration

Given the basic tension inherent in Problem-Focused Research and the resultant tendencies for Researchers to treat it as though it were Basic Research while Funders and Users tend to treat it like Development, NIE has a key orchestration role in mediating the inevitable conflicts between Researchers on the one hand and Users and Funders on the other hand--as well as reconciling differences in perspectives among Researchers from the various disciplines relevant to a given problem area.

Critical here is the orchestration of User and Researcher perspectives in problem selection--balancing Users' interest in targetting Research at problems where they perceive a real need and Researchers' concerns about the researchability of identified problem areas given the state of the art in relevant fields. If high quality Researchers are to be attracted to and maintained in large scale educational Research institutions that carry out Problem-Focused Research, the field and the institutional settings must be made attractive to them. As far as is feasible the forms and modes of funding and control must be made to accommodate their needs. It is vital to include the User perspective of problem area significance in initial project and program selection, but the overall balance will need to be redressed in favor of the protection of the Researchers' criteria of Excellence and researchability (so often lacking in the current situation).

This kind of orchestration will require great sensitivity and skill, and suggests the need for Agency personnel: a) who can work closely and well with both Researchers and Users; b) who can gain their trust and confidence while still maintaining the integrity of the Institute's perspective; c) who can intervene appropriately to make certain that the Research maintains its problem focus and that the problems selected for study both meet User needs and are in fact researchable and carried out in a manner likely to be productive.

The use of advisory panels to help NIE staff define Research program areas would seem appropriate. But their influence may well be somewhat limited until the field gains in strength. A danger to be avoided is the filling out of these panels with disproportionate representation from the Basic Research community (no matter how distinguished these Basic Researchers may be, especially those from the disciplines) and from the User community. Until more can be delegated to a stronger interdisciplinary field, NIE will have to be prepared to assume a larger share of the overall programming responsibility.

B. System Building

The fundamental point we emphasized in our analysis of the educational context was the relative absence of Problem-Focused Research settings with the required attributes of large scale, longevity, and Excellence. Further, we noted that prior funding policies had tended to transform the centers of applied work that do exist into what are primarily Development organizations.

The implication for NIE is that institution building (and rebuilding) is a very important need--and only NIE (through its funding, orchestrating, and managing) can provide the impetus for such a strategy.

Institution building implies:

1. locating existing or potential centers of excellence;
2. developing and supporting them in a manner that will permit the longevity of work teams and the kind of scaled operations that Problem-Focused Research often requires.

Specifically in relation to universities (as one obvious source for centers of excellence), the problem is the tension between (a) the need to keep the focus on Problem-Focused Research; and (b) the fact that Problem-Focused Research is generally not rewarded in the university setting. Thus, two alternative strategies could be:

1. to attract competent university Researchers to R&D organizations in the private and quasi-public sectors (which, however, would have the dysfunctional effect of weakening potential university centers of excellence); or
2. to provide joint-appointment arrangements wherein university Researchers can both maintain their university relationships (and security) yet also devote major amounts of their time to Problem-Focused Research in these R&D organizations outside the university setting.

In relation to large-scale R&D organizations in the private and quasi-public sectors, NIE's strategy will probably have to be one of re-building--i.e., developing funding policies with the needed focus, scale, and time-frame to permit these organizations to return to the Problem-Focused mold.

As in our discussion of institution building for the Basic Research function, system building will require a somewhat close, collaborative relationship with the field to permit the identification of potential centers of excellence with the required "minimum critical mass of talent." And as in Basic Research, with limited resources for funding and a wide array of potential problem areas for the focus of such funding, a policy of "placing bets" and concentrating funding on a few selected problem areas would seem preferable to scattering the available resources across a much larger range of problem areas and Research organizations.

The funding of Problem-Focused Research in education has been characterized for some time by a Catch-22 problem i.e., a funding pattern which requires Researchers to promise unattainable (or at the very least, highly uncertain) results in order to obtain funding. Thus, if you promise, you can't deliver. If you don't promise, you don't get funded.

NIE--and Users, Researchers, and the Congress--need to clearly understand that:

1. The problems selected must be important problems.
2. At the same time, the problems must be researchable.
3. The capacity does not really exist right now to meet those needs.
4. Thus, institution building (and rebuilding) is the prime need.
5. However, institution building is an ongoing, long-term process.

These points imply that Problem-Focused Research must be promoted as an important but long term contributor to education--one that requires a major investment now if the gap is to be filled, more for future than for present benefits Perhaps this is the only way to overcome the Catch-22 problem. Vital to such a strategy is that Users, the Congress and NIE have a clear understanding of the differentiation between Problem-Focused Research and Development.

C. Process Mode of Management

Given the size of the investment required for large-scale Problem-Focused Research, and recognition of the somewhat limited state of development of the field, a funding agency is likely to have a strongly felt need to exercise some control over its Research program. But,as we have emphasized repeatedly, Problem-Focused Research *is* Research, and it is carried out by Researchers. Therefore, it would seem essential for NIE to avoid a bureaucratic response. Tightly drawn RFP's that attempt to mandate targets, deadlines, procedures, etc. have limited likelihood of being effective and seem to be inappropriate substitutes for knowledgeable close interactive relationships between NIE staff and the field, especially where NIE staff include Researchers who function as an integral part of the field.

2. Considerations Internal to NIE and Non-Procurement Activities

A. Staffing

Recognizing the high cost of establishing large scale Problem-Focused efforts of appropriate critical mass, the visibility of such efforts, and the tremendous difficulty of keeping such work problem-focused (especially during a period in which the emphasis is to be on institution building and on attracting strong Research talent), NIE will be faced with the need to build a very strong internal group capable of close working relationships with the field--relationships that imply a substantial degree of leadership. This can be achieved only if such personnel are themselves involved in important Problem-Focused Research and have achieved some stature in the Research community.

Without such a relationship and a strengthened field (backed up by the needed in-house competence and activity), merely doubling or tripling the proportion of funding allocated to field-initiated Research would not seem to be a purposeful strategy in and of itself. Unless NIE is capable of orchestrating the Basic Research/Development tension, the quality control requirements, the institution building programs and the much greater amount of funding available for Problem-Focused Research from other agencies and, further, is capable of performing the monitoring of the total effort, then merely turning more of the initiative over to an overtly weak field would seem to be futile.

B. Internal Agency Structure

Given what we have said of the importance of separating Problem-Focused Research from both Basic Research and Development, it might be desirable for this separation also to be reflected in both organizational and budgetary structures within NIE. This would seem to be a matter that merits some attention within the Agency.

C. Non-Procurement Activities

Much of what we discussed earlier in relation to non-procurement activities of the Agency appropriate for the Basic Research function applies equally well to Problem-Focused Research. Included here might be such activities as: NIE Researchers conducting Problem-Focused Research of their own, possibly in collaboration with Researchers in the field; keeping in touch with the field through travel, telephone communication, attending and/or sponsoring seminars and conferences, etc.; facilitating the development of invisible colleges and other communication and quality control mechanisms needed for the cumulative development of relevant knowledge and technology bases; etc.

Here too, NIE Researchers might map potential problem areas, prepare syntheses and reviews of the state of available knowledge, etc., and use such documents for recruiting and attracting top Research talent to specific Problem-Focused Research areas--in much the same manner described earlier in our discussion of Basic Research.

The procurement implications of these kinds of staffing and non-procurement activities parallel those considered earlier for Basic Research. Here too, close interactive relationships between Agency and field, and collaborative development of Research proposals and programs, would seem possible if system-building considerations could be seen to take precedence over the rules of the game of competitive procurements. Inherent in this discussion may well be one of the most significant and controversial policy issues in need of NIE consideration--one fraught with enormous implications for the Institute as well as for the whole educational R/D&I system and its future development.

DEVELOPMENT

DEVELOPMENT

I. THE NATURE OF DEVELOPMENT

1. Introduction
   - A. User Focus
   - B. Dependence upon the Development State of the Art
   - C. Development and Production
   - D. The Steps in Development
2. The Centrality of System Linkages
   - A. Types of Linkages
     1. Need Identification Linkages with the User
     2. Linkages to the Development State of the Art
     3. Linkages to the Production Stage
   - B. The Agency Role: Monitoring and Orchestrating System Linkages

II. THE EDUCATIONAL CONTEXT OF DEVELOPMENT

1. The Lack of a Production Function in Education
2. The Development Knowledge/Technology Base
3. The Institutional/Personnel Base for Educational Development
   - A. Contractor Selection
   - B. Quality Control of Process Instead of Product
   - C The Locus of Quality Control
   - D. Development in the Quasi-Public and Private Sectors
4. Development Processes in Education
   - A. Project Selection
     1. So Many Needs
     2. Multi-Purposes/System Impact
     3. Portfolio Impacts
     4. NIE and Field Roles in Project Selection
     5. Potential Equivalency of Alternatives
     6. The Extent of NIE Influence in the Field
     7. Appropriate Evaluators
     8. Sources of Need Identification: Practice vs. Technological Opportunity
     9. Interrelationships and Orchestration: Some Implications
   - B. Two Basic Operating Modes in Educational Development
     1. Specialized Development Organizations
     2. Practice-Based/Practice-Related Development
     3. Strengths and Weaknesses of the Two Basic Modes
     4. The NIE Role

III. IMPLICATIONS FOR NIE BEHAVIOR

1. Procurement Behavior
    - A. The "What" of Development Procurement Orchestration
    - B. The "How" of Development Procurement Orchestration
    - C. Facilitating, Buying or Renting
    - D. Excellence in Development
    - E. The Effects of Funding Policy on Development Institutions
    - F. Competitive Bidding vs. Sole-Source
    - G. Single vs. Multiple Institutions
2. Non-Procurement NIE Activities
3. Considerations Internal to NIE
    - A. NIE Staffing and Development
    - B. NIE's View of its Relation to the Field

DEVELOPMENT

I. THE NATURE OF DEVELOPMENT

1. Introduction

A. User Focus

Development involves a process of converting knowledge into User-ready products.* The emphasis or focus of Development is the User. The end-product must be something a User can use (with at most some minimal fitting or tailoring). Thus, we use the term "User-ready" to emphasize that when a product is "developed," it is in a form that the User can potentially use--it is "ready" for use.

It follows rather obviously that Development is very dependent upon and thus must be very responsive to User needs. Further, we must emphasize that Development must be related to current User needs--not to some "foreseen" long-term future needs.

Of course, there is always the possibility to foresee (or project) a time when Users will be ready for a product which they do not currently see as a need. However, this kind of situation tends to be much more theoretical than real. Normally, a Developer has neither the capability to make such "putting products on the shelf" projections accurately nor the luxury to do so.

B. Dependence upon the Development State of the Art

Whether or not it is even possible to develop a specific product is, of course, determined by what the state of the art permits. Whether or not a product should be developed also depends on the state of the art. For example, there is no point in creating a product that is in fact out-of-date if the state of the art permits a superior product to be developed.

---

*As noted in an earlier chapter, for simplicity of usage we use the term "products" whenever we are referring to the outputs of the Development process. However, the reader should keep in mind that the term "products" is meant here to convey the full array of Development outputs--programs, processes, models, strategies, approaches, etc. as well as the narrower range of outputs we typically think of as "products."

We must note that we refer to the Development state of the art -- not to the Research state of the art. As we will note later, there is in fact very little direct transfer from Research into Development. The products of Research appear in long-term, indirect ways. By contrast, Development products generally come from a more certain, established knowledge base -- i.e., Development products tend to be based upon or are an extension of other kinds of Development products. In simple terms, an existing product is modified, improved, etc., or a well developed concept is turned into a usable product.

C. Development and Production

Development is the creation of a product in a form in which it can be used directly or duplicated for wider use.

In the generic sense, the end of Development is the beginning of Production. Once a product is developed, Production begins and at some later time (usually soon after Production begins), the Producer disseminates (distributes, markets) the product to the User.

In some fields (where the products are essentially technologies, e.g. in education), this clear-cut process of Development/Production/Dissemination/Utilization generally does not exist. In such cases, the actual Production may be carried out by the Users themselves. After Development is completed, the next step is usually simply informing the User how to reproduce the developed product. Thus, in education, a clear-cut, separate Production stage often does not exist.

D. The Steps in Development

The Development process will depend to some degree on the nature of the product being developed. However, in one form or another the process will generally involve: Need Identification, Development justification and feasibility, design, model or prototype building, testing, packaging (which may include creation of Implementation/Utilization instructions), pilot dissemination, large-scale field testing, final modifications.

2. The Centrality of System Linkages

A. Types of Linkages

In Development, three system linkages are of critical importance; i.e., the linkages between the Developer and:

1. the User (for Need Identification)
2. the Development state of the art
3. the Production stage.

1. Need Identification Linkages with the User

Normally we tend to think of Need Identification as occurring at the beginning of the Development process--i.e., when the User (either directly or through some intermediary) works with the Developer to define the area of need. Typically, Need Identification is then considered to have been completed.

This, however, is a very limited concept, one that works well only under conditions of overall system maturity and certainty--i.e., when:

1. the Users can clearly specify what they need;
2. the Developer (and Producer) can know exactly what the Users mean;
3. the Developer is then capable of producing the developed product and then saying with assuredness to the Users: "Here is what you asked for";
4. it is then obvious to the Users what to do with the product.

As an example, an airplane manufacturer may well be able to specify so clearly the requirements for a needed airplane part that the part can be developed to specifications and then, in effect, simply "plugged in."

In contrast, of what value is such an isolated, simplistic process of Need Identification under conditions of overall system immaturity and uncertainty (such as in education), when the User cannot clearly tell the Developer what is needed, when the Developer would not really be sure how to go about developing the product even if the User were to give clear specifications, etc.?

Under these conditions, Need Identification must be seen as a broad, ongoing, continuous process--a process that:

1. enables the Developer throughout the various stages of Development to seek and receive additional information and clarification from the User;
2. not only involves successive stages of the Development process, but is continuous through Dissemination, Implementation, and Utilization, until the need has been refined sufficiently for a usable product to be developed.

In a word, under conditions of overall system immaturity and uncertainty, Development is a continuous process of adjustment and modification--a tailoring of the product which does not end with the generic "Development" stage but continues through the User aspects of the R/D&I process.

2. Linkages to the Development State of the Art

While not as critical or as difficult as linkages between the Developer and the User, the linkage between the Developer and the Development state of the art is nonetheless important. The Developer does need to know what has been done, can be modified or improved, can be applied to a particular project.

The linkage is to the Development knowledge base. This does not mean that linkage to Problem-Focused Research cannot at times be helpful. (Indeed, some Problem-Focused Research quite often occurs concurrently with the Development process--i.e., as the Developer runs into "problems.") This also means that the linkage to Basic Research is at best tangential and occasional.

3. Linkages to the Production Stage

A not uncommon breakdown in the R/D&I process occurs when a developed product is given to the Producer in a form that (for whatever reason) is not practical or feasible for Production purposes. This is not surprising. If Developers are doing their job, they have kept in mind that the final product must be in a form which the User can use. We simply note here that the Developers also need to consider that the developed product (prototype, model) can be manufactured, where such a function is needed. To know what are the Production constraints, criteria, etc., the Developer needs communication linkages with the Producer.

B. The Agency Role: Monitoring and Orchestrating System Linkages

The mission of a funding agency in Development is in essence to insure that adequate Development is (or can) occur. Because Development is a system phenomenon, a major Agency responsibility is to monitor and orchestrate the system linkages. We emphasize the system nature of Development simply because Development cannot be isolated from Production, Dissemination, Implementation, and Utilization.

In a mature system, this role is likely to be relatively smaller, as there may have developed natural linkages which provide for a high degree of self-monitoring and self-orchestration.

Contrarily, in the uncertain conditions of an immature system, monitoring and orchestration may be a significant Agency role.

II. THE EDUCATIONAL CONTEXT OF DEVELOPMENT

1. The Lack of a Production Function in Education

As we have already noted briefly, in the educational context, Development often does take on aspects of Production--simply because a separate Production stage and apparatus often does not exist.

When no mass production is involved, the developed prototype may indeed be the sum total of Production. Then the issue is simply one of informing Users of the prototype.

In other instances, the Production phase may occur at several unrelated points in time (instead of over a single, continuous point in time). The prototype or model is put into the system, in the literature, in ERIC--for retrieval by Users whenever they wish.

Of course, there are types of outputs (games, books) for which there may be a distinct Production stage. Here the issue to be considered is: who is willing and capable to do Production?

In cases where the Development work has been done by a commercial firm, the carrying out of Production activities is usually not a problem. Commercial firms tend to have well developed Production capabilities. And their right to control the nature of the output in its final form cannot really be challenged given their joint role as both Developer and Producer.

However, when the Developer is government-funded, questions about commercialization in the Production stage arise inevitably. Production considerations may suggest major changes in the Developer's prototype if Production is to be carried out on a sufficient scale and/or if it is to be kept within specified costs. In such instances, the Developer will have to reconcile his desire for Production on a scale that would permit widespread Dissemination and Utilization, with his desire to maintain the integrity of his prototype and to control the character of the final product. This is clearly an issue worthy of some attention, but one that we cannot deal with here.

Mention should also be made of the difficulty encountered occasionally when commercial Producers acquire the rights to a larger number of Development outputs than they can readily produce over the short run. The consequence here may be that the product's dissemination is delayed for some time (if not, perhaps, forever). This potential problem suggests the need for considering the possibility of agreements with commercial Producers that entail forfeit of the Producer's rights to a product if its Production and at least the beginnings of its Dissemination are not accomplished within a specified time period.

For a variety of reasons, a product may not be commercialized--either by intent or by default, or for lack of interest from commercial Producers. Where Production activities of some kind or other are called for by the very nature of the product, then the question becomes: if not commercial Producers, who will do Production? There are a number of possible answers. Perhaps the Developer will do Production -- perhaps even the User or various kinds of intermediary organizations created to link Producers and Users. The character of that Production may well vary depending on who in the system actually carries out the Production work.

2. The Development Knowledge/Technology Base

There seems to be general agreement that the educational Development knowledge/technology base is weak, that its quality is generally poor. Even when one can point to some highly valuable Development knowledge or some highly useful Development technology, access to quality information of this kind is difficult:

a. Developers do not know what other Developers have done or can do.

b. There is little codification of Development knowledge/technology-- the kind of codification to which Developers could turn and on which they could rely. There is an absence of "handbooks." Lacking too are distinct, discrete, Development-relevant categories to facilitate information searches.

c. The transforms or linkage mechanisms between stages of the educational R/D&I process are weak (e.g., there are so many unknowns in education that Research findings do not readily get translated into Development products; almost equally ambigious may be the linkages between Development and Production or Dissemination). Considering that Development is a continuous process across various R/D&I stages, such transforms or linkages are quite important.

In light of the above, quality control becomes a key issue for educational Development. Further, since the quality control needs to be continuous throughout and even beyond the Development stage, there is a strong logic for breaking up the procurement of Development into stages. As an example:

Stage 1: The Developer is asked to present NIE with a *concept* for development of a product.

Stage 2: The Developer is asked to create and pilot test a *prototype*.

Stage 3: The Developer is asked to develop a *scaled up version* ready for large-scale Dissemination.

At each stage, the Development process could be reviewed, refined and even stopped. The point is simply that NIE cannot afford to *assume* that adequate quality control will be provided throughout an entire Development cycle.

This stage-by-stage quality control could be accomplished through either of two basic strategies.

1. A single Developer could be funded for the entire Development process, but NIE would review the Developer's work at various stages in the process.
2. Each stage of the process could be funded separately. This would allow NIE the option (at each stage) to continue with a single Developer or to open each stage to competition.

The point to be emphasized here is simply that NIE should think about Development procurement along lines such as these. And if NIE is going to consider such strategies, a fairly active NIE involvement is required--as contrasted, for example, with NIE simply providing long-term funding to a Developer who proposed what appears to be an exciting, potentially significant Development project. Such NIE involvement may seem onerous at times--but in educational Development, some active degree of NIE involvement is bound to be necessary.

Finally, we must note that in education, the difficulty of developing "product standards" is such that the very concept may be meaningless. The educational literature contains examples of some of the more rigorous Development organizations striving to develop "product specifications" prior to designing and testing prototypes.

However, due to the "soft" nature of the product in education, the weakness of the overall knowledge base of the field, and the general resistance to developing and using tight product specifications or standards--either in the design phase or in the course of formative or summative evaluations-- there seems little point at this stage in the maturity of the educational R/D&I system to invest in development of product "standards" as the solution to the issue of quality control. More productive may be an investment in designing Agency quality control monitoring processes that have within them the built-in potential for documentation and analysis of Development processes and the cumulative development of a stronger Development knowledge/technology base.

3. The Institutional/Personnel Base for Educational Development

The institutional/personnel base for educational Development is weak. There are some strong Development organizations, but only relatively few, especially in comparison to other fields (e.g., Health). There are personnel doing Development, but relatively few personnel trained in the Development process.

The weak institutional/personnel base raises at least three major issues for NIE.

A. Contractor Selection

On the one hand, NIE must consider whether a potential contractor has the kind of professional capabilities and skills to handle Development throughout its various phases.

Thus, selecting a competent contractor is a key role for NIE. However, the need for building an educational Development system is so strong that NIE must be equally concerned about ensuring an adequate Development institutional and personnel base from which competent contractors can be selected. In many cases, this will mean that NIE will have to take the initiative in seeking out and developing contractors (as contrasted to simply responding to field initiation or selecting from among those organizations willing to invest resources in responding to competitive procurements).

B. Quality Control of Process Instead of Product

Given the weakness of this institutional/personnel base, and the difficulties inherent in either devising or using meaningful product standards for quality control of the Development function in education, NIE will do better to attempt to exert quality control over the Development process rather than attempt what are likely to be fruitless efforts to control directly the quality of Development products. NIE can exert some control over the Development process by determining how the contractor is going to approach a Development project, who is going to be involved, etc.

C. The Locus of Quality Control

Quality control may be provided in either of two ways.

In a mature system, there will likely be a large degree of effective field-initiated quality control.

In an immature system (such as education), however, effective field-initiated control will tend to be missing. Thus, quality control mechanisms will need to be set up by the Agency. (An exception can and should be made in those few instances where the Development institutions are able to and do exercise a strong degree of self-control over quality.)

In the educational context, quality control could be provided directly by NIE; or NIE could procure the services of other organizations for quality control; or, as the field matures, NIE could gradually facilitate the development of field self-control over quality.

We must further note that the locus of quality control will tend to shift through the various phases of the Development process. In the initial phases, NIE must play an important role -- e.g., with respect to Need Identification, how Development will be done, who will do it, etc. As the Development process moves towards finalization of a developed product, User involvement will tend to be more important than NIE involvement. Thus, NIE should design and provide the mechanisms that will gradually shift the locus of quality control from NIE to Users.

D. Development in the Quasi-Public and Private Sectors

Finally, we may note some differences between Development in the quasi-public and private sectors.

When Development is done in the commercial (private) sector, there is in the long run a built-in quality control mechanism: if the product is not good, it is not likely to sell for long. This is especially true in fields where there are sophisticated Users. Further, in the commercial sector, the Development/Production/Dissemination phases are integrated. The danger here is not so much that of selling a low quality product as it is selling the User products he does not need.

In contrast, as we have been noting, when Development is funded by the government in the quasi-public sector, quality control cannot be assumed, nor is the Developer automatically linked into the total Development/Production/Dissemination process.

4. Development Processes in Education

Two aspects of Development as a process merit particular attention because of their potential implications for NIE behavior with respect to the field.

A. Need Identification: Program Definition/Project Selection

1. So Many Needs

It must be understood that especially in education, there are far more needs than can be met at any one time. This fact necessitates having some form of project or program selection process. Further, given the limited resources of NIE, the major criterion must be cost/effectiveness, with effectiveness being seen in system terms of multi-purposes and of portfolio effects.

2. Multi-Purposes/System Impact

Any particular procurement should be examined not only in terms of its stated purpose, but also in terms of additional ways the project might (or could be used to) impact various parts of the educational system. For example, the project could have the additional impacts of:

a. building the capability of the Developer;
b. creating linkages;
c. helping the User during Implementation and Utilization;
d. impacting the educational Development environment by helping people see educational Development in a better light.

Thus, a premium should be placed on those projects which not only have important manifest purposes but which also can provide multiple additional impacts upon the total educational system.

3. Portfolio Impacts

Similarly the cost/effectiveness of a given project should be evaluated in terms of its overall impact upon and within the total portfolios of projects and programs at NIE and at the various Development institutions.

For example:

a. How many Development products (and what kinds) can be disseminated without overloading the User? Over what period of time?
b. Would it be better for NIE to concentrate its resources in a single area in order to obtain synergistic and multiplier effects, in contrast to scattering its resources among many "good" but unrelated projects? Such a consideration would also suggest the need to examine how other (non-NIE) sources of funding were being used, and how funding might be coordinated across funding agencies to obtain synergistic and multiplier effects.
c. To what extent would a given project tend to tie up a significant portion of an institution's resources? For how long?
d. What would a particular project do to the balance between high- and low-risk projects? Short-term and long-term projects? What kind of balance does NIE want to have? What kind should a given institution have?

Thus, considerable emphasis should be placed on those projects which fit best into the total portfolio of projects.

Other illustrations could easily be given of multi-purpose and portfolio impacts. The point is simply that project selection should be considered not just from the viewpoint of a single project in isolation but also from the viewpoint of total system impact.

4. NIE and Field Roles in Project Selection

Viewed from this above perspective, project selection is not merely the evaluation of proposals. Even more significantly, project selection is a key element of system orchestration, in Development but also (of course) in other R/D&I system functions.

Further, from this perspective, it becomes possible for NIE to think of potential divisions of roles between NIE and the field.

Specifically, the field should be involved primarily at the point of proposal evaluation, while NIE must take responsibility for project and system orchestration.

The field should be in the best position to evaluate whether an innovation is "good" or "bad," at least in terms of such key criteria as: relevance to User need; User capability to implement and utilize; state of the art; User climate for acceptance; etc. Parenthetically we may note that to the extent NIE lacks education professionals on its staff, NIE will be dependent upon field evaluation. This dependence is not an issue here. By allowing the field to provide evaluation from its perspective and capabilities, NIE is freed from some unnecessary additional burdens and can focus its resources on: a) the evaluation of proposals in terms of orchestration and total system impact, and b) doing the actual orchestration. At the same time, we do not want to downplay the importance of having education professionals on the Institute's staff. They would seem to be needed to help give an education perspective to NIE's orchestration role.

The field cannot really be of much help in making orchestration and total system impact evaluations simply because they are not likely to be in touch with (or even know about) all the elements of the NIE

a. building the capability of the Developer;
b. creating linkages;
c. helping the User during Implementation and Utilization;
d. impacting the educational Development environment by helping people see educational Development in a better light.

Thus, a premium should be placed on those projects which not only have important manifest purposes but which also can provide multiple additional impacts upon the total educational system.

3. Portfolio Impacts

Similarly the cost/effectiveness of a given project should be evaluated in terms of its overall impact upon and within the total portfolios of projects and programs at NIE and at the various Development institutions.

For example:

a. How many Development products (and what kinds) can be disseminated without overloading the User? Over what period of time?
b. Would it be better for NIE to concentrate its resources in a single area in order to obtain synergistic and multiplier effects, in contrast to scattering its resources among many "good" but unrelated projects? Such a consideration would also suggest the need to examine how other (non-NIE) sources of funding were being used, and how funding might be coordinated across funding agencies to obtain synergistic and multiplier effects.
c. To what extent would a given project tend to tie up a significant portion of an institution's resources? For how long?
d. What would a particular project do to the balance between high- and low-risk projects? Short-term and long-term projects? What kind of balance does NIE want to have? What kind should a given institution have?

Thus, considerable emphasis should be placed on those projects which fit best into the total portfolio of projects.

Other illustrations could easily be given of multi-purpose and portfolio impacts. The point is simply that project selection should be considered not just from the viewpoint of a single project in isolation but also from the viewpoint of total system impact.

4. NIE and Field Roles in Project Selection

Viewed from this above perspective, project selection is not merely the evaluation of proposals. Even more significantly, project selection is a key element of system orchestration, in Development but also (of course) in other R/D&I system functions.

Further, from this perspective, it becomes possible for NIE to think of potential divisions of roles between NIE and the field.

Specifically, the field should be involved primarily at the point of proposal evaluation, while NIE must take responsibility for project and system orchestration.

The field should be in the best position to evaluate whether an innovation is "good" or "bad," at least in terms of such key criteria as: relevance to User need; User capability to implement and utilize; state of the art; User climate for acceptance; etc. Parenthetically we may note that to the extent NIE lacks education professionals on its staff, NIE will be dependent upon field evaluation. This dependence is not an issue here. By allowing the field to provide evaluation from its perspective and capabilities, NIE is freed from some unnecessary additional burdens and can focus its resources on: a) the evaluation of proposals in terms of orchestration and total system impact, and b) doing the actual orchestration. At the same time, we do not want to downplay the importance of having education professionals on the Institute's staff. They would seem to be needed to help give an education perspective to NIE's orchestration role.

The field cannot really be of much help in making orchestration and total system impact evaluations simply because they are not likely to be in touch with (or even know about) all the elements of the NIE portfolio; to know which institutions need building; what funding is available from what sources for what projects; etc. In other words, the field has neither the system information nor the system perspective to make a total system evaluation or to take responsibility for orchestration.

Finally, we may note that the field's lack of a total system perspective may well be a strong point in favor of NIE permitting the field to play a major role in evaluating individual proposals. Since the judgments of NIE personnel are likely to be affected by their concerns about system building, etc., evaluations of individual proposals by the field provide the Agency with a rather different set of evaluative judgments to input into the project selection process--judgments based on the merits of individual proposals alone, unhampered by the other kinds of concerns that would arise inevitably from application of a total system perspective.

5. Potential Equivalency of Alternatives

In Development (as elsewhere to some degree), it is not obvious and clear that one product will be of more benefit or is more necessary in the long run than another product. Innovation rarely comes from a once-and-for-all "great breakthrough." Rather, significant innovation generally results from a series of small improvements, and such improvements may result from a myriad of alternative approaches, methods, projects, etc.

Thus, NIE will always be in the position of making cost/effectiveness orchestration judgments, not only between proposals, but between the need to orchestrate the field, on the one hand, and the value of a given innovation, on the other. And NIE will not have the luxury of certainty about its judgments. This does not mean that NIE should avoid the responsibility of making cost/effectiveness judgments by relying on others (e.g., a panel of "experts" from the field). As we have already noted, the field cannot orchestrate. Rather, the Agency staff, after obtaining the best information it can, must simply accept the responsibility to make (and live with) orchestration judgments.

6. The Extent of NIE Influence in the Field

In terms of funding, NIE is only one of many sources which fund education or education-related Development. NIE is not even the largest funding source. Further, NIE does not have the power or status of such other funding agencies as the National Institutes of Health.

Nonetheless, since NIE is the lead agency for Research and Development in education, its orchestration role is vital. Futher, even though NIE may not have a large _direct_ influence on the field, NIE can have a significant _indirect_ impact on education through its orchestration role, by tailoring its efforts carefully in terms of such criteria as: knowing what is and is not being done; knowing where the strengths and weaknesses of the system lie; knowing where it can and cannot help. Indeed the combination of NIE's relative smallness and its having the lead responsibility make its orchestration role even more important.

7. Appropriate Evaluators

Selection of personnel to evaluate proposals, projects and products is a key element for an overall NIE Development project selection strategy. Determining _at what point_ (during the overall Development process) each evaluator has an appropriate role is also important:

1. Users have a valid evaluation role at three main points:
    a. early in the Development process, to identify their needs;
    b. at the point of proposal evaluation, to help NIE evaluate the specific merits of individual proposals;
    c. later in the Development process, as products begin to enter the _developed_ stage; and then as products are implemented and utilized, so as to provide corrective feedback to Developers and/or Producers.
2. Developers should have a role early in the process to help identify what projects should be worked on, especially to provide some input into decisions about what is possible given the Development state of the art.

3. Researchers will play a very minor role in the evaluation process. Where the state of the art leads to a very large degree of uncertainty, Researchers might be able to provide some insight.
4. NIE has two basic evaluation roles:
   a. NIE must evaluate proposals from the total system impact perspective (multiple purposes and portfolio impact).
   b. NIE must also select the evaluators from the field, both in terms of individual capabilities and perspectives and of providing balance in the field evaluation. For example, if there is to be an evaluation panel, it is NIE's responsibility to determine how many and what Users, Developers, Researchers; at what different points in time; organized in what ways; etc. In other words, the use of field evaluators should be a carefully thought-through and planned process, one which can vary according to situation.

8. Sources of Need Identification: Practice v. Technological Opportunity

Thus far we have been emphasizing practice-based needs--i.e., the needs identified by Users, which are based on their everyday experience. It is also important to consider needs which are technology-based--i.e., when it becomes technologically possible to develop a product, consideration must be given to developing(and in some cases even promoting strongly) that product.

The issue now becomes: What is a proper portfolio balance between needs as currently understood by the field and responsiveness to what has recently become technologically possible. On the one hand the "bread and butter" type of Development is generally based upon User identified needs. On the other hand, it is likely that the accumulation of Development and Research knowledge will at times make possible the development of a very significant product. Thus, NIE will want to orchestrate a portfolio that permits strong technological opportunity types of Development work to be supported.

The implication for the NIE-orchestrated selection process is that Users will predominate in the evaluation of User-based needs, and Developers (with some help from Researchers) will predominate in the evaluation of technological-opportunity-based Need Identification.

9. Interrelationships and Orchestration: Some Implications

To summarize some points we have been making:

1. Consideration must be given to potential synergistic effects across projects that may result from developing a portfolio of interrelated projects--as contrasted to a lack of synergistic effects from an unconnected set of unrelated projects.
2. Consideration must be given to work that is supported elsewhere (e.g., by the Office of Education, the National Science Foundation, other non-government foundations). Here the relevant issues would be (for example):
    a. How can the various funding sources pool resources and orchestrate efforts to develop synergistic effects across projects?
    b. How adequate are the non-NIE sources of support in a particular area? Are they such as to allow NIE to give its attention and support to other areas?

B. Two Basic Operating Modes in Educational Development

Basically, there are two rather different operating modes through which the Development function is carried out in education--Development work as it is generally carried out in specialized Development organization, and Development work as it tends to take place in practice-based (or practice-related) settings.

1. Specialized Development Organizations:

The Development function as it is carried out in pursuance of government contracts--primarily in federally-funded regional laboratories and R&D centers and in some of the non-profit and for-profit Research and R&D corporations--tends to adhere, at least in form, to the engineering model of Development used in industry.

Development in these settings is an institutionalized specialty carried out by specialized personnel in specialized Development organizations or organizational units. In the best of these organizations, Development activities tend to be systematic and sequential, moving in a smooth progression from the prototype design that is the end product of the Research phase of R/D&I, to product or program Development in accordance with detailed specifications, to evaluation of small field tests, to revisions, to larger field tests, to more revisions, to an additional field test, etc. until the product performs in accord with prespecified performance objectives. Products go through successive generations of revisions, each a closer and closer approximation to the performance specifications. Revisions are based on empirical field test data that are gathered systematically and analyzed rigorously, and the evaluation data are expected to provide the potential User with information about the outcomes or effects to be expected from use of the product under specified Implementation conditions.

Clearly, there is a considerable amount of Development work carried on in these organizations that does not adhere faithfully to this relatively rigorous model of the Development function. But equally clearly, this does appear to be the model they are trying to use in planning and conducting their work.

Development projects implemented in accord with this model tend to be large-scale and expensive, involve large personnel pools and heterogeneous skill mixes, and require extensive cooperation between the organization developing the products and the school systems agreeing to serve as field test sites. The products themselves are often complex, consisting of many and varied modules or components, and often several forms of media as well as printed materials. The management of these complex projects is often highly formalized, using flow charts and sophisticated management tools.

There are some variations in pattern depending on the nature of the products being developed--e.g., products vs. change processes. But the issues of concern to managers tend to be consistent--e.g., How much Research is needed prior to the Development work; how much Research can proceed parallel to the Development work? At what point is the product sufficiently developed to permit initial field testing? At what point has the product been tested sufficiently to permit Dissemination? What Dissemination, Marketing, and Implementation factors need to be considered throughout the design and development phase? At what point does the responsibility of the Developer end--Development? Dissemination? Installation? Utilization and Maintenance?

These issues are to some extent common to the Development function in all sectors, but they take on particular significance in education. The weakness of the knowledge and technology base of the field makes it more difficult to translate performance specifications into effective products. Outcomes are much less predictable given: a) the nature of the interaction between User and product and b) the limited technical capability of Users to implement complex innovations without substantial Implementation supports and/or assistance. Consequently, Development work in education requires a far greater investment of time and money in the Research and Evaluation components of the R&D process, making Development costs high relative to practical payoff, a problem of particular importance considering the negative political climate in which educational R&D appropriations tend to be made.

2. Practice-Based/Practice-Related Development:

A rather different mode of Development is inherent in traditional approaches to the design and development of instructional strategies and materials--as these activities have been carried out by classroom teachers, by curriculum specialists in SEAs, LEAs, and universities, by publishers, and by the university scholars who have on occasion participated in efforts to improve K-12 level curricula and instructional materials in their areas of specialization. We note in particular the significant amount of program design and development that has been carried out within LEAs in response to the availability of categorical funding from federal (and some State and other) sources--e.g., ESEA Title I and Title III funding from the Office of Education.

The Development approach used in these settings tends to be intuitive rather than data-based or grounded in instructional theory. The focus of attention is generally on the content to be conveyed rather than on conceptions of how teachers go about providing instruction. Field-testing is non-existent or minimal. Whatever evaluation is carried out tends to focus on the face validity (e.g., expert judgments, teachers' subjective perceptions and reactions) rather than measured effectiveness in achieving prespecified impacts. There may not be a systematic testing program or rigorous analysis of empirical data. In comparison to the Development mode that characterizes specialized Development organizations, there is less likely to be a systematic cyclical test and revision sequence. Even where some evaluation and revision does take place there is less likely to be extensive recycling, and it is highly unlikely that evaluations would be made in terms of a product's effectiveness in achieving prespecified measurable objectives.

There are other significant contrasts between the two Development modes. In comparison to the pattern in specialized Development organizations, Development costs in practice-based (or practice-related) settings tend to be relatively low. The personnel involved are relatively few (e.g., one teacher, a few scholars or curriculum specialists, etc.) and whatever skill mixes are present in a Development team tend to be relatively homogeneous. Management is generally informal and highly flexible.

Within the practice-based/practice-related mode, two important variants can be identified, depending on whether or not the product or program of interest has been developed with the intent of wide-scale dissemination in mind. Where textbooks or materials packages are being developed for large-scale, nationwide dissemination, an effort is usually made to include Implementation supports in the form of teachers' guides, tests, etc. Where materials are developed locally within the User system for use by a single teacher or group of teachers in a single school or District, far less of the Implementation process is committed to print or media presentation, the state of "development" of the materials or strategies for use outside this small group remains inadequate, and either the locally developed innovations are not disseminated at all or they are disseminated but have minimal success elsewhere because Development work was not carried far enough to permit the materials to be implemented easily and effectively by others.

The exemplary practices or programs that have become the focus of so much attention in recent federal and State Dissemination programs fall within this practice-based mode. Where exemplary practices or programs are neither designed in a form that permits them to be generalized to other schools or Districts, nor packaged in a form that permits dissemination, these practices/programs may provide potential inputs for the Development function as this is carried out in the specialized Development organizations. We shall return to this point shortly.

3. Strengths and Weaknesses of the Two Basic Modes

Given that Development work in education tends to be carried out in one or the other of these two basic modes, our first concern must be to identify the strengths and weaknesses of each mode. We will then be in a position to identify several issues with significant implications for NIE behavior.

a. Specialized Development Organizations:

The specialized Development organizations in the educational R/D&I system have (at least potentially) several basic strengths. They are generally large in scale and tend to be staffed by sizeable numbers of skilled personnel--(quite possibly) at the "minimum critical mass" level. These personnel are more likely than the practice-based and practice-related Developers to be knowledgeable about the Development state of the art. These organizations tend to have the capabilities needed to undertake large-scale projects and are generally able to carry out all steps of the Development process.

These organizations also have several potential disadvantages. Because they are external to the User system, they may tend to be isolated and insulated from User needs--working, as it were, in an "ivory tower" setting. Dissemination and Implementation may be problematical because of inadequate linkages to the User population and/or to intermediary organizations, because their products may not be sufficiently relevant to User needs, and because the User may react to these externally developed products in terms of the all-too-familiar "not invented here" syndrome. Given the high costs of rigorous Development work in these specialized organizations, the relatively limited utilization of their outputs to date in User settings, and increasing recognition of the extensive amount of local innovation that exists in some parts of the User system--questions continue to be raised about the relative efficacy of this Development mode. If this mode is to remain viable it would seem essential for NIE to relate to these organizations in a manner that strengthens their functioning.

b. Practice-Based/Practice-Related Development:

The obvious advantage of the practice-based/practice-related mode is its general closeness to real User needs and problems, especially in those cases where the Developer is the User or is at least part of the User system.

However, several disadvantages of this mode are also obvious. For example:

1. This tends to be an inefficient and at times ineffective mode. Since the personnel carrying out

this kind of Development work tend to be part-time Developers at best (and often people who may carry out Development work only once or twice or very few times)--personnel who by training, background, and commitment tend to be identified with other kinds of activities--there is limited likelihood of these Developers being very aware of the Development state of the art. Thus, there will tend to be much "re-invention of the wheel"--duplication of effort, etc. Further, most of the Developers who carry out this type of Development work lack both the skills and time needed for sophisticated and complex developmental activity. (One important exception here are the Production personnel who generally work for textbook publishers. But even in the publishing example, the university scholars or education practitioners who may do the bulk of the conceptual and substantive, as opposed to editorial and Production work, are likely to fit the above description.)

2. Even when the Development output appears to be high in quality, there is generally little accompanying empirical evaluation data to serve as the basis for making quality control judgments or Adoption/Adaptation/Implementation decisions.
3. When Development work is carried out within the User system--whether in classrooms, curriculum committees, teacher centers, LEA or SEA offices--the output (a curriculum, a set of materials, etc.) is being developed for a particular local component of the User system and is generally not automatically input into some broader Dissemination system able to make it accessible to a larger population of potential Users. Thus, there are rather substantial problems

encountered in identifying and disseminating high quality developmental work carried out in these settings.

4. There is one other significant problem related to the fact that this kind of output is generally being developed for only a local component of the User system--by a User-Developer for personal use, or by a Developer who can interact personally with a relatively small number of Users (e.g., an LEA curriculum coordinator, or a teacher working with other teachers in her school or District). More often than not, the kind of Implementation information that a User-Developer is likely to carry around in his/her head is not elaborated in print or through media presentations. For this is the kind of information that the User-Developer generally feels need not be committed to paper for personal use, and can be readily communicated orally in interpersonal exchanges with other Users in the school or District with whom he or she may share the Development output. If this kind of output is to be disseminated more broadly it must be packaged properly--a problem usually beyond the time and skills (and probably the interest) of the individual Developer-User.

c. Issues

In relating to the specialized Development organizations in the educational R/D&I system, the key issues for NIE to consider would seem to be:

1. the extent to which NIE should specify the substance of, and/or provide direction to, their Development activities;
2. the extent to which emphasis should be given to

system building and/or rebuilding; and

3. how to overcome the Dissemination weaknesses inherent in this operating mode based in settings external to the User system.

In relation to practice-based/practice-related Development work, the key issues for NIE would seem to be:

1. to what extent these outputs should be validated, and what mechanisms might be most appropriate for whatever degree of validation is seen as needed;
2. what mechanisms might be most appropriate for identifying high quality materials, programs, practices, etc. developed within the User system; and
3. what strategies might be most appropriate for supplementing the efforts of the Developer-User at various steps in the Development process that are not likely to be carried out adequately (or at all) without the intervention of some State or federal agency or some intermediary organization (e.g., the packaging, Production, and Dissemination of exemplary programs or practices created by User-Developers).

It is woth noting that Dissemination is an issue for both of these two basic modes of educational Development.

Given that these are two very significant modes of educational Development, the overarching appears to be: on the one hand, how to capitalize on their strengths while on the other hand, how to build into the system countervailing forces to overcome their weaknesses.

4. The NIE Role

It can be seen from the above delineation of issues that NIE must accept responsibility for orchestrating the linkages--simply because the need is there and there is no other agency with the authority (or perhaps too the inclination) to do this orchestration.

In relation to the large-scale Development organizations, there is a need to develop the linkage between these organizations and Users. NIE should be directive in developing and controlling the linkage *process*. That is, NIE should insure that the process leads the Developer both to develop products that are needed and to disseminate these products. This is related to our earlier point about the needed User role in Development program definition and project selection.

In relation to the practice-based mode of Development, the needed NIE role would seem to be to develop and/or facilitate mechanisms which would permit the *identification* of exemplary practices and other outputs which could and should be generalized, packaged and disseminated (and probably validated as well). The question now arises: who should begin the process by identifying exemplary practices, etc. for input into more formalized and rigorous developmental activity, e.g., packaging and validating? On the one hand, Users could identify such practices and bring them to the attention of some other (probably intermediary) organizations. On the other hand, intermediary organizations could bear the brunt of these "search and discover" operations.

Once such exemplary practices have been identified, they must then be recast in forms that are generalizable to other settings, and then, they must be packaged, produced, and disseminated.

Where organizations with the needed capabilities already exist in the field, NIE's role would seem to be to facilitate their work (and where possible their growth) by providing resources and/or making it more feasible in other ways for them to function better and to grow.

However, if the needed organizations do not exist (or are too few), NIE's options would seem to be to either "buy" or "rent" the needed capabilities. The "buying" strategy would involve a direct attempt to create insitutions that would become a permanent part of the educational Development system. A "renting" strategy would entail the temporary purchase (therefore, the term "renting") of services from organizations that already possess the needed skills but are external to the educational R/D&I system. In this case, a "gap" in the system is "filled," but only temporarily, on a project-by-project basis. The advantages of the "renting" option are that the packaging, production, etc. can be done quickly, NIE can be rather directive about what is to be done, and the funding need be for a specified (short-term) period only. The disadvantage is that this option does not increase the overall long-term capabilities of the educational Development system. We shall return to this point later in our analysis.

Thus far we have discussed possible NIE roles and options vis à vis Development organizations and practice-based Developers as separate, unrelated courses of action. However, if NIE were to pursue a "buy" strategy for packaging exemplary programs, practice-based Developers and Development organizations could be linked in such a way as to improve the overall, long-term capabilities of the educational Development system. Here, the role of NIE could be to create special linkages between Users and Development organizations such that the flow of exemplary practices into the Development organizations for packaging and dissemination would become a normal and permanent part of the Development system. Initially, we would anticipate that the bulk of the exemplary practices that would flow into the Development system for packaging and dissemination would be identified by intermediary organizations specifically assigned the task of identifying exemplary programs, practices, approaches, etc. operational in the User system. Over time, however, we would anticipate an increase in User-initiated communication of exemplary practices to the Development organizations. This linkage and communication flow might be strengthened over time as the outputs of these Development organizations become increasingly User-relevant and high-quality. Under such conditions, we might hope for a greater User awareness and appreciation of the role of these Development organizations.

Thus the real issue is:

1. whether NIE wants to insure that many exemplary practices are identified, packaged, and disseminated quickly (and therefore might choose the "rent" option); or
2. whether instead NIE prefers to build slowly and facilitate development of capabilities and linkages that will become permanent and expand the capacity of the overall system (and therefore might choose instead to function in a "buy" mode with built-in system building potential).

III. IMPLICATIONS FOR NIE BEHAVIOR

1. Procurement Behavior

The key theme throughout this analysis of educational Development has been that NIE is not simply a "channel" for funds. Rather, NIE has a major orchestrating role because the context calls for this type of role, the need is so great, and there is no other institution available to carry out this role. Further, orchestration implies not simply a balancing of types of products or programs, but also--and more importantly--a balancing of purposes. As noted in our introductory chapter, when NIE makes a procurement, it may procure:

1. a product or a program;
2. system building; and/or
3. some change in the environment of the educational system.

Whether it intends to do so or not, whenever NIE makes a procurement, that procurement may affect one, two, or all three of the above purposes. Thus, for example, a procurement made with the manifest purpose of permitting the rapid design of a given product may achieve that particular purpose and have little if any discernible systemic impact. Or, the procurement may achieve the manifest product-design purpose while at the same time also strengthening (or weakening) the long-term capabilities of a particular part of the educational Development system.

A. The "What" of Development Procurement Orchestration

Throughout this analysis, we have noted a number of specific items which NIE can and should orchestrate through its Development funding policy. For example:

1. obviously, a specific, relevant, and usable Development product;
2. system linkages (e.g., between Users and Developers, between Developers and the Development state of the art);
3. balance among and between multi-purposes and portfolio

effects;

4. coordination and synergistic effects between NIE and other funding agencies and/or combinations or projects;
5. system building and rebuilding.

B. The "How" of Development Procurement Orchestration

We have noted a number of options or alternative strategies concerning the methods of orchestration.

1. NIE can operate in a consensus building mode, i.e., providing the mechanisms whereby field personnel can come together to reach agreement as to key issues, directions, etc. Basically this is a process of orchestration through the use of field personnel for inputs to key planning decisions. However, we note that NIE must orchestrate the selection both of which field personnel and which mechanisms are to be utilized, and in relation to what issues or concerns.
2. NIE can choose to orchestrate through the proper selection and placement of advisors in relation to specific aspects of the Development function. That is, NIE can orchestrate procurements through decisions about who will be involved in Need Identification, in various stages of quality control, in making decisions about field testing and packaging, etc.
3. Orchestration may be carried on through staging the procurement process--either by using different contractors for different stages of the Development process (e.g., different contractors for Need Identification, designing, field testing, etc.); and/or funding only one stage at a time, reviewing after each stage, and then continuing, modifying or terminating the process.
4. NIE has choices to make among the strategies of facili-

tating, buying or renting. We will discuss this more fully below.

Regardless of which combination of the above options NIE chooses, there are two aspects of orchestration methodology which our analysis has emphasized. These are:

5. Orchestration requires a monitoring process. Thus, monitoring becomes a critical NIE activity that has to be continuous and ongoing.
6. Given the nature of the educational R/D&I system as a whole and of the educational Development system in particular, orchestration of process is likely to be more fruitful (and even feasible) than directive control of products.

C. Facilitating, Buying or Renting

NIE can choose among facilitating, "buying," or "renting" strategies, both within projects and across its total portfolio of Development projects. We discussed these options earlier in connection with the packaging, production, and dissemination of exemplary practices developed within the User system. The same points could apply equally well to other kinds of Development activities.

As noted earlier, though, it should be underscored that the choice among these options must be based in part on the kinds of capabilities that do or do not exist at a given point in time within the educational R/D&I system. A facilitating strategy is possible for NIE only where the needed capabilities exist to some degree or other within the educational R/D&I system. If the needed institutions do not exist (or are too few), the facilitative strategy is irrelevant. Thus, NIE would then have to create the needed parts of the system, either on a permanent basis (buying) or on a temporary basis (renting).

Each of these strategies call for a somewhat different management mode by NIE. Where a facilitating strategy is possible, the collaborative mode of management is most appropriate. The buying and renting strategies, in contrast, call for and permit a more directive mode of management by NIE, with renting requiring/permitting the most directive approach.

Three points should be made here:

1. Both buying and facilitating are system-building modes. Renting is not, though some system-building capabilities can be built into a renting strategy.
2. In general NIE should seek to build the educational Development system (though there are exceptions, as we shall note), and where possible it is best to build through the facilitation of existing institutions.
3. NIE has been receiving some criticism from the field for behaving in a manner that some in the field view as overly directive. While we, in this analysis have been emphasizing a process rather than a directive management mode for NIE, we must also note that at times NIE may have no choice but to be directive. A facilitative mode, by definition, is relevant only when conditions in the field permit. When there is a lack of adequate capability in the field, it is this weakness which requires the taking of a directive approach.

Some additional comments would seem to be in order about the renting strategy. As already noted, renting is not a system-building strategy. That does not mean renting is by definition a "bad" or "lesser of evils" strategy. For one thing, the nature of Development is such that there may be a large number of specialized tasks. Where a task is highly specialized, and/or seldom used, renting may indeed be the "best" strategy. There is nothing inherent in the Development process that requires all tasks to be performed by organizations within the Development system of a particular sector.

A second point is that renting can be very helpful as an interim strategy--either because it is simply necessary, or because at a given time NIE is not yet certain whether there is or is not a long-term need for building a specific internal system capability.

Nonetheless, where renting is used as an interim strategy, NIE must recognize that renting can retard system development. If NIE wants to develop a particular internal system capability in the long run, there is the danger of never starting the process of building simply because the products being rented look so much better than what initially could be obtained within the system.

Thus, where renting is an interim strategy, there should be some mixing of renting and buying strategies. For example, the rental contract might mandate a certain amount of training for personnel within the educational Development system.

Finally, even when renting is a valid strategy, there are factors which will tend to constrain NIE's willingness to use the strategy--e.g., a high price, a large amount of sub-contracting, etc.

D. Excellence in Development

We should note here that while "Excellence" may be considered a desirable procurement objective, "Excellence" has a meaning in Development rather different from its meaning in Research--a difference that significantly affects funding policies and decisions.

In Research, "Excellence" is measured against the best the field can do working at the outer limits of the state of the art. Thus, in Research, "Excellence" implies creativity, the utmost in understanding and knowledge, even "breaking through" or expanding the limits of the state of the art. In Research, "Excellence" is not measured against practical considerations such as cost, time, operability, availability, usability, etc.

In contast, Development "Excellence" *is* measured by these *practical* operational criteria and is *not* measured by the "outer limits" of the state of the art.

For example, in Development there may be a choice between two potential contractors. The first can develop a product which is "good enough to do the job," and can do so at a reasonable cost and within a reasonable period of time. Further, to fund this organization would result in strengthening the overall Development system. By contrast, the second organization can develop a product which is potentially superior and certainly more creative, but can do so only at a much higher risk and cost and it may take much longer. Further, funding the second organization would not result in any overall or long-term strengthening of the Development system. In Research, the wise policy would be to fund the latter organization. In Development, however, it may be a wiser policy to fund the first of these organizations.

In Development, usability is the key criterion of Excellence. Usability, costs, time-frame and system-building would seem to be the criteria most appropriate for project selection.

E. The Effects of Funding Policy on Development Institutions

NIE should keep in mind that its funding policy toward Development institutions tends to mold the character of these institutions. It is the nature of institutions (particularly the more mission-oriented) to tend to become what their funding sources (on whom their existence depends) demand of them in terms of kinds of products, kinds of skills, kinds of risks, etc. It is, in simple terms, a case of "He who pays the piper calls the tune." This dynamic is especially true of Development organizations, for they, in sharp contrast to Research organizations, tend to be able to acquire rapidly the skills required by the types of projects funded. For example, in comparison to Research organizations, Development organizations tend to have a clearer division of labor, tend to acquire personnel specializing in less creative areas of work, which require less knowledge, etc.

A related concern is whether (and to what extent) NIE should fund Development organizations on a programmatic as contrasted to an institutional support basis. NIE has been grappling with this issue since the beginning of its existence. The tide now appears to be moving back noticeably toward acknowledging the need for some degree of institutional support for organizations with which it has (or chooses in the future to have) a "special relationship"--or at least some kind of balance between institutional and programmatic support.

We note this concern because (in contrast to Research organizations) Development programs which are government-funded tend to allow very little room for interpretation or maneuvering. When a Research program is funded, there is a sufficient level of uncertainty involved to permit the Research organization to choose from among a variety of alternatives and still remain within the program's guidelines. By contrast, a specified Development product tends to be defined more narrowly and the Developer's options are considerably more limited.

Thus, for the overall health of a Development organization, some institutional funding would seem to be essential, whether this be 10% or 20% or some other figure. Otherwise, the creative aspect of that organization will be stifled and its character molded to a very large extent by the funding agency.

F. Competitive Bidding vs. Sole Source

We must now call attention to an issue which is, to an important degree, political. Government policy favors competitive bidding for government funding, and for very valid reasons. However, the very concept of orchestration (especially in the context of an immature system such as educational R/D&I in general or educational Development in particular) implies that there will be a significant (probably predominant) need for sole-source type of funding.

Orchestration requires the ability to control the various parts and aspects and purposes of system funding. By definition, competitive bidding takes away from the funding agency a significant part of its ability to orchestrate. Even when there is competitive bidding, the ability of a potential contractor to "fit into" the funding agency's orchestration efforts may have to be one of the criteria for the contractor's being permitted to submit a bid and/or for the selection of one bid over another. For example, if one of NIE's orchestration objectives is to build a few strong Development organizations (as compared to funding many weak institutions with little or no system-building effects, given limited NIE resources), a fully open competitive bidding policy for each individual product or project may well negate such NIE orchestration efforts and capabilities.

G. Single vs. Multiple Institutions

Thus far, our discussion may seem to imply the funding of a single institution to carry out a particular project. This need not be the case. There can be good reason to fund several organizations to work on a single project. For example:

1. No one institution may have all the capabilities needed on a given project. For example, one may be strong in Need Identification because of strong ties with Users--but have lesser product design skills. Rather than eliminating that organization from the project, an option could be to fund a second organization for the product design stage. Another example could be a product requiring the perspective of different disciplines (e.g., psychology and sociology as well as education). Under such circumstances, NIE might

choose to fund a collaborative relationship between two or more organizations with the necessary perspectives and skills.

2. Collaboration between two or more organizations could have synergistic effects.

The use of several organizations could take a number of forms. For example:

1. Staging. Different organizations would be funded for different stages of the Development process. Here the role of NIE would be to orchestrate and facilitate the transitions between stages and organizations.
2. Collaboration. Several organizations would be funded to work together on the same stage or stages of the Development process. Here, NIE's role would be significant in selecting the organizations and perhaps facilitating their collaboration.
3. Supplementing. Here, one organization would have primary responsibility but would need some supplemental help in one or more aspects of the process. Here, the NIE role could be either to select an organization which has connections with "satellites," or to select the supplemental organizations.
4. System building. Here, a weak but potentially valuable organization could be "paired" with a stronger organization. The "weaker" organization could thus gain experience. Here, the primary NIE role is selection.
5. Funding Coordination. Where other funding agencies either are or could be involved, the use of more than one Development organization might simply be a political necessity in order for funding to be coordinated. Further, the use of multiple Development organizations could be seen by the various funding agencies as having a potential synergistic

benefit.

Regardless of the form, use of multiple organizations would necessitate some form of orchestration by NIE.

2. Non-Procurement NIE Activities

Thus far we have tended to focus on the procurement activities of NIE, i.e., those actions which lead to the award of (and invovle Agency personnel in monitoring) grants or contracts for various R/D&I outputs. Indeed, if one were to analyze NIE's activities solely in terms of its expenditures, it might well seem that the Institute's role is defined largely in terms of procurement activities.

However, there are various other kinds of activities which NIE could initiate, or facilitate, and we have mentioned some of these at various points in our analysis. Examples of these non-procurement activities include:

1. Coordination and collaboration with other agencies funding Development activities: NIE is the lead agency for Research and Development in the education sector, and is the only existing agency with a legislative mandate "to build an effective R&D system" for education. Thus, it is the only organization that can legitimately claim some "right" to function in a system orchestration role.
2. Conferences and seminars: We have noted several kinds of communication linkages which are weak or missing in the educational R/D&I system. Conferences and seminars provide one way to provide some communication between groups and to develop the informal communication networks which tend to exist in more mature R/D&I systems. Such conferences might bring together: Users and Developers (to improve the Need Identification process, or to provide Developers with

linkages to exemplary practices in the field); regional groups of Users (with a focus on either some specific topic of relevance to the region or simply beginning the development of informal regional communication linkages); Developers (again, to help Developers become more aware of possible project linkages among different Developers, and to begin development of informal networks); etc.

3. Considerations Internal to NIE

A. NIE Staffing and Development

The educational issues and potential NIE roles which we have been discussing have implications for the kinds of staff NIE needs, the kinds of skills its staff must have, and the kinds of structures which are or are not relevant to NIE.

While the scope of this study does not permit full delineation of these implications, some observations may nonetheless be made.

1. The emphases of this analysis on: a) orchestration as a major role of NIE and b) process facilitation as a basic management mode call for organizational structures and management styles and skills other than those normally associated with a bureaucratic type of organization.
2. Further, these same emphases, in the context of the immaturity of the educational R/D&I system, call for staff personnel in NIE who are educational professionals and who continue to be actively involved in various aspects of the field.
3. A somewhat decentralized rather than highly centralized type of organizational structure would seem to be better suited to gaining entry into the User system, to developing linkages with and between various parts of the educational system, and to facilitating system building within

the field.

B. NIE's View of Its Relation to the Field

Most of this analysis has focused upon an orchestration role for NIE. The question at this point would seem to be: Does NIE accept that role for itself? Or does NIE prefer to play a different role?

If NIE is willing to accept the orchestration role, then the Institute must begin the process of developing the kinds of goals, priorities, policies, structures and staffing that are relevant to and/or required by this role. In this process, it may very well be that a certain amount of internal re-orientation and re-training would be wise and/or necessary. We shall return to these considerations later in our analysis.

DISSEMINATION

I. THE GENERIC CHARACTERISTICS OF DISSEMINATION

1. Introduction
2. The Place of Dissemination in the R/D& I System
    - A. System-Creating Phenomenon
    - B. A Linkage Process
    - C. Optimizing Interaction and Fit
    - D. Many Modes and Products
        1. Many Products
        2. Many Modes of Dissemination
        3. User Familiarity and Acceptance
        4. Fail-Safe
    - E. R/D&I System Maturity
        1. Immature R/D&I System
        2. Mature R/D&I System
    - F. The Role of Intermediary Organizations
    - G. Long Term Objective: Developing a Mature System
3. Key Building Blocks
    - A. Elements External to the User
        1. Information from Knowledge Sources
        2. Quality Control
        3. Sorting and Retrieval
        4. Tailoring
    - B. Elements Primarily in the Domain of the User
        1. Trial
        2. Adoption and Implementation
        3. Utilization
    - C. Elements either User or Producer Initiated
        1. User Awareness
        2. Matching to User Needs
    - D. Linking Producers and Users
        1. Dimensions (Sub-Blocks) of Producer-User Building Blocks
        2. Devising Producer-User Strategies
    - E. Identifying Key Issues for Dissemination Process
4. Factors Affecting Dissemination as a Process
    - A. Cost/Effectiveness as a Factor
    - B. Professionalism and Reliability Factors
    - C. Motivation and Commitment
    - D. Trust
    - E. Replicability of Developed Dissemination Media
    - F. Overall: A Complex Process

5. Key Problem Areas
    A. Scope of the Problem
        1. Size of the User Population
        2. User (Market) Variations
    B. Producer/User Breakdowns
        1. Information Flow
        2. Producer Motivation
        3. User Motivation
        4. Skills
        5. Supplemental Resources
        6. Patterns of Adoption
    C. Knowledge About the Dissemination Process
6. Design Requirements and Strategies
    A. Congruency and Adaptability
    B. Stability
    C. Management Mode
    D. Quality Control
    E. The Producer/User Match
    F. Buying and Renting Services
    G. Product Championship
    H. Stimulating User Demand
    I. The Developmental/Emergent/Experimental Strategy
    J. Fail-Safe Mechanisms

II. DISSEMINATION IN THE EDUCATIONAL CONTEXT

1. Level of Maturity of Educational R/D& I as a Whole
2. User Setting
    A. Scale
        1. An Enormous Number of Users
        2. A Tremendous Diversity and Variety Among Users
    B. Motivation and Technical Capability
3. Climate
4. Numerous but Fragmented Dissemination Efforts
5. Recent Federal and State Initiatives in Dissemination
    A. Three Modes of Dissemination
        1. Creation of a Comprehensive Resource Base
        2. Product Advocacy
        3. Change Process Advocacy
    B. Some Specific Current Strategy Developments
        1. Centralized Resource Base: The Expansion of ERIC
        2. The States as Intermediate Dissemination Mechanisms

        - 3. More Active Dissemination/Utilization Strategies
        - 4. Two-Way Communication
    - C. A Note of Caution
- 6. The Personnel Base
- 7. The Institutional Base

III. IMPLICATIONS FOR AGENCY BEHAVIOR

- 1. Procurement Behavior
    - A. Orchestration as the Main NIE Role
    - B. System Facilitation and System Building
    - C. Process Mode of Management Control
    - D. Attention to Linkages/Transforms
    - E. Use of Mixed Strategies
    - F. Control Growth and Expansion Rates
    - G. Monitoring
    - H. Mandatable Features
- 2. NIE Skills Required

DISSEMINATION

I. THE GENERIC CHARACTERISTICS OF DISSEMINATION

1. Introduction

In the sense of a segmented conceptual model of a total R/D&I process, Dissemination may be considered as a separate, distinct part of the process--specifically as the link which takes a developed product* and sends or gives information about the product (or distributes and delivers the product) to the User population.** Thus, on this conceptual basis, we picture as distinct a separate Dissemination element of the R/D&I process--an element having tangential boundaries with Producers/Developers on the one hand and with Users on the other.

In a more complete systems sense, however, Dissemination cannot be viewed as a basically isolated segment. Precisely because it is the link between Research/Development on the one hand and User Selection/Implementation/Utilization on the other, we must conclude that for both theoretical and practical purposes, Dissemination either does not exist or exists dysfunctionally when the Research/Development and/or the Selection/Implementation/Utilization functions occur inadequately or inappropriately, or (in the case of Selection/Implementation/Utilization) do not occur at all.

---

*As noted in earlier chapters, for simplicity of usage we use the term "products" whenever we are referring to the outputs of the Development process. However, the reader should keep in mind that the term "products" is meant here to convey the full array of Development outputs--programs, processes, models, strategies, approaches, etc. as well as the narrower range of outputs we typically think of as "products."

**We recognize that the definition of Dissemination that has achieved some degree of consensus in education today includes two-way communication between Producers and Users, with Users "feeding forward" to Producers information about their perceived needs as well as evaluative feedback on the products they have tried to use. However, although we are aware that a combined Dissemination and Feed-Forward (D/FF) system is being designed by NIE, we view Feed-Forward as a conceptually discrete function, and therefore do not treat it here in this analysis. Feed-Forward is an additional function we might consider in some future, expanded analysis.

In a word:

a. The kind of Dissemination system needed in a given sector is dependent on the nature and level of maturity of the total R/D&I system.

b. A Dissemination system is useless (and even dysfunctional) if it is not designed in accordance with the realities of the existing overall R/D&I system.

By way of contrast, it is more possible to think of Research and Development as separate, isolated elements simply because there is an identifiable end result--there is a "product," even if it figuratively "sits on the shelf" and is never used.

Similarly, it is also more possible to think of Implementation/Utilization as separate, isolated elements. Users do implement and use products, methods, processes, etc.--even though few Users may use a particular product; or the product is of poor quality; or the product is used inappropriately or inadequately. Also, these products may or may not have come from external R&D-based sources (in a direct sense). On the other hand, the "end product" of Dissemination is the effective Selection/Implementation/Utilization by relevant Users of products which are both adequate and relevant to the User's need.

Thus, it makes sense to think of the Development/Dissemination/Implementation/Utilization process as a package with the focus being on the User.

To illustrate, where the overall R/D&I system is immature, several conditions will tend to exist which significantly impact upon the effectiveness (and thus upon the design) of the Dissemination system.

1. The transforms between the steps of the R/D&I process are not clear. That is, it is not obvious (for example) how Research results can be applied to Development; how quality control is to be done in relation to Production; how the product will get to the User.

2. User knowledge tends to be highly limited. The User may not know a product exists, or how to differentiate between a "good" and a "bad" product; or how to effectively use a product--or, because of these factors, the User may not even try the product.

Thus, when the R/D&I system is immature, certain kinds of Dissemination policies, strategies and mechanisms may be needed which are not needed when the R/D&I system is mature.

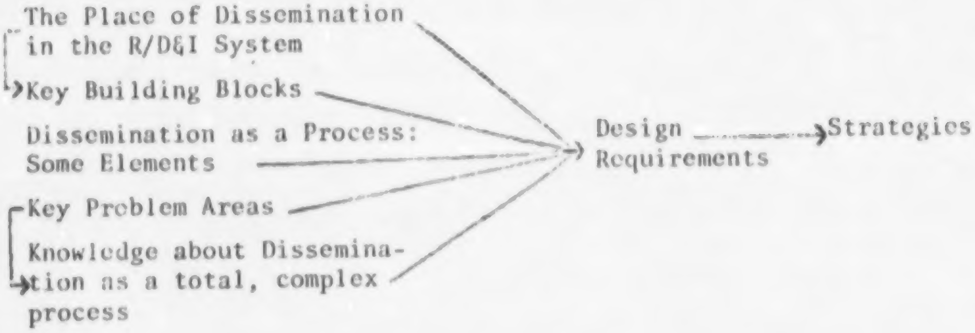
Viewing the Development/Dissemination/Implementation/Utilization process as a "package," it now becomes possible to consider the question of appropriate Federal agency policies and strategies in Dissemination. As a preliminary comment, we may note that Agency options are limited by certain factors:

1. The further the Dissemination "package" goes into the User system, the less control can or should be maintained by the Agency. That is, the Agency may have high control over the Dissemination aspect, less over User Implementation, and even less over Utilization.
2. The larger and more fragmented the User system, the more difficult it becomes for the Agency to be directly involved (in an effective manner) with Users.

The discussion which follows is predicated upon the above understandings of the Dissemination process and of Dissemination systems. We will first examine what role Dissemination has in the overall R/D&I system. From this context, we will be able to identify some of the key building blocks of a Dissemination system. Next, we will focus on strategic elements of Dissemination as a process, and then on some of the likely key problem areas for Dissemination. We will also comment on the state of knowledge concerning Dissemination as a total, complex process.

From the above, we will suggest some relevant Dissemination strategies. The outline and process of the discussion which follows may be represented schematically as in Figure 1.

FIGURE 1


The Place of Dissemination in the R/D&I System
Key Building Blocks
Dissemination as a Process: Some Elements
Key Problem Areas
Knowledge about Dissemination as a total, complex process
Design Requirements
Strategies

2. The Place of Dissemination in the R/D&I System

To understand the nature of (and effectively develop) a Dissemination system, it is vital to have a clear understanding of how Dissemination fits into and affects the overall R/D&I process.

A. System-Creating Phenomenon

In the first place, we must be aware that Dissemination is a system-creating phenomenon.

This is true because without Dissemination a total R/D&I system simply does not really exist. Research and/or Development can indeed exist independently--but unless there is also a link to the Users, Research merely produces knowledge in isolation, and Development merely produces products which, in effect, "sit on the shelf." Thus, mechanisms for disseminating the results of Research and Development to Users must exist for a total R/D&I system to exist.

Where the R/D&I system is immature, Dissemination mechanisms may have to be created (where none exist) and/or supplemented and supported (where inadequate mechanisms exist). Where the R/D&I system is more mature and formalized, institutionalized Dissemination arrangements may exist in the form of mechanisms that permit direct Producer (or Supplier)/User relations.

B. A Linkage Process

It follows from the above that Dissemination, in its essence, is a linkage process--a linkage process so important and so critical that the total R/D&I system does not exist in its absence. The functions of this linkage process are essentially three-fold:

a. To inform Users of the results of Research and Development which are relevant to and usable by them.

b. To enable Users to effectively utilize the results of Research and Development.

c. To enable Developers and Producers to develop and produce products which fit User needs.

Viewed from this perspective, several important implications become obvious:

a. It is vital that the Dissemination systems operate with clear understandings of the User organizations with which they interact.

b. Dissemination systems and mechanisms must be tailored to the nature and style of the User organizations.

c. The products to be disseminated must be matched both to User needs, to User capabilities, and to User readiness to adopt new products, programs, processes, and even new Dissemination mechanisms.

d. It is important to keep in mind that the relevance of any specific Dissemination mechanism is determined by whether or not it helps achieve Dissemination purposes. A specific Dissemination mechanism is not important in and of itself. Thus (as we shall later note), in any given situation, several different Dissemination mechanisms may be reasonably effective.

However, we must also note that normally most Users will tend to be slow to adapt to new information sources, new mechanisms, new modes of operation, new materials and products. In this regard, it may at times be good strategy to utilize and improve an existing Dissemination mechanism (with which the User is familiar and comfortable) rather than to introduce new Dissemination mechanisms (which in themselves may require change by the User).

C. Optimizing Interaction and Fit

Finally, from all of the above, it follows that in the design of Dissemination processes there is a very high premium on designing Dissemination mechanisms that will optimize interaction with Users and will thus also tend to optimize the fit between Products and Users. However, as a strong caution, we must also make a distinction between creating mechanisms for Dissemination and achieving Dissemination objectives. That is to say, the mere existence of Dissemination mechanisms does not guarantee that Dissemination will actually occur.

D. Many Products and Modes

From the previous discussion of the importance of designing Dissemination mechanisms which optimize interaction with the User and fit between Product and User, an erroneous conclusion could easily be drawn--i.e., that there is one best set of Dissemination mechanisms and that NIE should discover and design that set. There are at least four important reasons why such a conclusion would not only be erroneous, but also potentially dysfunctional.

1. Many Products

How a Dissemination system will function in practice depends to a significant degree on the types of products being disseminated. Even within a given sector (e.g., education or health), there will be a degree of product variation sufficient to call for certain differences in Dissemination mechanisms. For example, the methods most appropriate for

Dissemination of a very simple product are likely not to be at all appropriate for the Dissemination of a very complex technology; and vice versa. Thus, there must be a fit between the "what" (Product) and the "How" (Dissemination)--a fit that will tend to vary across product types.

We may also note here that this linking of product type with types of Dissemination mechanisms can, over time, lead to some degree of specialization by Disseminators in relation both to the type of products which they will tend to disseminate and the Dissemination mechanisms which they will tend to utilize.

2. Many Modes of Dissemination

In any given situation, there are likely to be several modes or mechanisms which would be reasonably and more or less equally effective for the dissemination of a particular product or type of product. In such a situation, the issue is not: Which is the best?; but rather: Which is available? Which already has User confidence (or lack of confidence)? What are the cost differentials? etc.

3. User Familiarity and Acceptance

It is important that Users have sufficient confidence in the source of Dissemination information so that they will be at least initially favorably inclined to try out an innovation. It is not unreasonable to anticipate that in many instances, out of all the possible relevant and reasonable Dissemination mechanisms, a User (or group of Users) will have confidence in one particular Dissemination mechanisms because of prior positive experiences with it. Thus, where possible, it would be reasonable to utilize that mechanism. Given the large number of Users nationwide, we would expect different User sets to have different "favorite" Dissemination mechanisms. Each separate Dissemination mechanism may gravitate towards a specialization in the dissemination of a relatively limited line or type of product, but for that line or type of product, it is potentially a highly effective Dissemination tool for a given set of Users. This need not be viewed as a factor limiting improvement in practice. As we have noted, a wide variety of different innovations may be potentially helpful to any given User; and presenting a User with too wide of a set of alternatives may result in a dysfunctional state of confusion.

4. Fail Safe

As we will note more fully later, the Dissemination system needs to be made fail-safe, since it is reasonable to expect that Users will from time to time have "bad" experiences with Dissemination sources, which when going through a "learning curve" may lead to premature and long term rejection.

We have just noted that when the User has had "good" experiences with a Dissemination source, the positive experience should be reinforced and capitalized upon. The reverse is true when the User has had "bad" experiences with a Dissemination source. In this situation, reinforcement should be avoided--but if there is only one Dissemination source available to the User, the "bad" experience will be reinforced and the User will tend to discredit and reject the entire Dissemination system.

Thus, it makes sense to provide the Users with several alternative Dissemination sources, such that if they experience failure with one source, they can go to another source instead of rejecting the entire Dissemination system.

In summary, there are many Dissemination modes or mechanisms which could potenially optimize interaction with the User and the fit between products and Users. No single mode or mechanisms (or even set of mechanisms) is likely to be clearly "the best." Further, there are a number of very good reasons to follow a policy of permitting and supporting the successful functioning of a variety of Dissemination systems.

E. R/D&I System Maturity

The type of Dissemination system required varies as a function of the degree of the maturity of the R/D&I system.

1. Immature R/D&I System

When the R/D&I system is immature, several key conditions will tend to exist:

a) There will be general lack of quality and quality control in Development (and also in Research).

b) Users will generally have a low level of effectiveness in Implementation; Users may be (to a large extent) unaware of what is available for their use; and Users will lack the evaluative capability to distinguish between "good" and "bad," "relevant" and "inappropriate" products.

Under these conditions, the Dissemination system must be designed to find, evaluate, categorize, store, and retrieve information about what is available. Further, the Dissemination system must provide mechanisms to enable Users to be aware of, properly select, and be capable of implementing the particular Development product which is most relevant to and usable by them. Such mechanisms may be provided either by the creation of new mechanisms or by the utilization, modification or improvement of existing mechanisms.

2. Mature R/D&I System

When the R/D&I system is more mature, a different set of conditions tends to exist.

a) Products of good quality and mechanisms for quality control will be more readily available.

b) Users will tend to have a higher degree of familiarity with products; they will better know how to find, select, implement, and use new products.

Under these conditions, an agency with an R/D&I system-building mission will have less need to be concerned about establishing Dissemination mechanisms (though there may still be such a need) and will be able to focus its attention on different specific aspects of the overall Dissemination process (e.g., ensuring outreach and disseminating thin market products to small special groups).

F. The Role of Intermediary Organizations

The role of intermediary Dissemination organizations deserves special attention at this point. (By intermediaries we mean organizations external to both Producers and Users.)

As described above, the conditions existing when the R/D&I system is immature may require that intermediary Dissemination organizations and mechanisms exist to perform those functions which are not being performed (or are being inadequately performed) by Producers/Developers and Users (e.g., quality control, User search, testing evaluation). Indeed, it is likely that the Agency will have to establish such intermediary mechanisms.

However, as the R/D&I system matures, the need for intermediaries may decrease over time and the role of intermediaries will change. For example, as Producers become more capable of developing quality products, the need for intermediary quality control mechanisms diminishes. Indeed, the need for some intermediary mechanisms and functions may completely cease to exist.

A key issue arises for the Agency in connection with these intermediary mechanisms. Organizations and institutions, once established, tend to seek to continue their existence. Thus it becomes imperative, from the beginning, that the Agency build adaptability into the intermediary mechanisms it stimulates and funds--and even provide for the possible demise of these mechanisms.

G. Long Term Objective: Developing a Mature System

A basic long-term objective of the Agency should be to facilitate the transition of an immature R/D&I system into a more mature system. The Dissemination system should be seen as a key element in achieving this objective for two reasons:

a. The vital role of Dissemination as a linkage process requires that mature Dissemination mechanisms be a part of any mature R/D&I system.

b. Under the conditions existing in an immature R/D&I system, the intermediary Dissemination mechanisms tend to fulfil functions usually associated with Producers and Users in more mature systems. Thus, Dissemination becomes a potentially strong entry point for facilitating the maturation of other parts of the total R/D&I system.

3. Key Building Blocks of a Dissemination System

From an understanding of the overall R/D&I system and of the place of Dissemination in that system, it now becomes possible to identify some key elements (or building blocks) of a Dissemination system.

A. Elements which are Primarily External to the User

1. Information from Knowledge Sources

Mechanisms must be provided that can determine what is available. This could be information about products currently under development; products that have been around for a long time but have not been widely used; or even exemplary practices within User organizations which have not become known outside of a particular User organization.

2. Quality Control

Mechanisms must be provided to sort out the "good" from the "bad" products, i.e., those products which are useful and relevant as contrasted to those products which do not work or are not appropriate.

3. Sorting and Retrieval

As there will likely be more products than a User can reasonably be expected to be aware of, some mechanism must be developed which will allow Users to identify and obtain the particular products which are relevant to their needs.

4. Tailoring

Because of the diversity among User organizations and their needs, it is probable that existing products will not quite "fit" User needs and will thus have to be "tailored" to fit a particular User organization.

The relative definitiveness of the problem/solution fit in a given instance would significantly influence how these different elements might be used in working with a given User. In some instances, there might be a variety of innovations that could assist Users in their (often loosely defined) needs, and one might decide to provide them with information on a broad array of alternatives. In other cases, however, it might be far from clear which products would be more or less useful. In these circumstances, it becomes the objective of the process to eliminate the clearly inappropriate, while narrowing down the choice to roughly comparable alternatives from which the User could select.

B. Elements which are Primarily in the Domain of the User

1. Trial

In the initial stages of Dissemination, whether initiated by the User, by Producers/Developers, or by an intermediary agency, the nature and method of Dissemination must be designed so as to motivate the User to give the new product a trial. Unless this is done, the overall Dissemination process breaks down and stops.

2. Adoption and Implementation

Dissemination is not merely a "sending out" of information. Dissemination must also be concerned with what is done with the information after it is received and tried by the User. This should be obvious, for the purpose of "sending out" information is to increase the Adoption and Implementation of new products, materials, processes, etc The point is emphasized here because Dissemination often is understood simply as a "sending out," with a resulting neglect of what Users do--or are able to do--with the information they receive.

3. Utilization

Dissemination systems must also include provision for continued Utilization--not just Adoption and Implementation followed by discontinuance.

The role of Dissemination in Adoption, Implementation, and Utilization is to insure that Users will receive the help they need to make effective use of what they receive.

C. Elements which may be Either Producer or User Initiated.

1. User Awareness

Mechanisms must exist through which the User can become aware that a product exists which may be relevant to his needs.

2. Matching to User Needs

Mechanisms must exist by which the sources and/or Supplier of products and information on products can become aware of User needs in order to permit the sorting/retrieval and tailoring described above.

In both of the above, the initiative may come validly from the Users, from Producers/Developers, or from intermediary agencies. The Users may be looking for a particular innovation, or a message may be sent to the Users to inform them of a particular innovation.

4. Devising Producer/User Linkage Strategies

A. Dimensions (Sub-Blocks) of Dissemination System Building Blocks

Each of the building blocks considered above might be described in terms of dimensions (or "sub-blocks"). Thus the building block "information from knowledge sources" might be elaborated by reference to such sub-blocks as: the distribution of printed materials, face-to-face presentations, conferences, demonstration programs, etc.

The design of Dissemination strategies is essentially a process of combining these building blocks, and especially the various building block dimensions or "sub-blocks". The effectiveness of these strategies is likely to be dependent on the extent to which these component building blocks and "sub-blocks" are properly selected, sequenced and timed for a particular target User and a particular innovation. For example, in one situation an appropriate Dissemination strategy might consist of: a series of introductory "flyers" or brochures; a visit to a User to ascertain needs; search and sorting to identify appropriate available products; a second visit by a representative of the disseminating agency; perhaps followed by informal discussion to zero in on a given innovation; a demonstration by other current Users of the innovation; and a promise of needed service and support. In a different situation, such a Dissemination strategy might be inappropriate.

B. Key Issues in the Design of Dissemination Strategies

From the above we can identify at least three key issues that must be considered in the design of Dissemination strategies:

1. What is the appropriate combination of "building blocks" in a given situation?

2. What is the appropriate organization for implementing the Dissemination strategy in a particular situation? In determining the appropriate organization, some relevant questions might be: Who works with the User? Who has the relevant knowledge and skills? Who knows (or can obtain sufficient knowledge about) the particular innovation?

3. What type of role is the Agency to have in implementing a Dissemination strategy? For example, will it have a direct operational role in the Dissemination process, or will it play an indirect role facilitating the activities of Producers, Intermediaries, and Users? In either case, what will be its major objectives and modes of operation?

5. Factors Affecting Dissemination as a Process:

A. Cost/Effectiveness as a Factor

At the very outset, one must be aware that Dissemination is a very cost-dependent process. The Disseminator has large publics at both ends of the process. That is to say, the Disseminator must be in touch with the various Producers and Developers, on the one hand, and with the various Users, on the other. Further, there are a variety of Dissemination media to be considered, each with different costs attached.

Much of the discussion about Dissemination in the literature focuses on the effectiveness factor, but less emphasis is given to cost/effectiveness. This is unfortunate, for the Disseminator must consider cost/effectiveness of various Dissemination media in relation to the dissemination of a particular innovation to a particular User public. For example, mailing 10,000 brochures may result in a low percentage of response (in terms of Adoption, Implementation, Utilization), but such a mailing might be relatively inexpensive and could reach a very sizeable audience. Hence, even with a low response rate, a substantial impact might be attainable for the cost and time involved. By way of contrast, having three staff members make trips to User sites could tend to be more effective (with the Users contacted) but might be relatively more costly and time-consuming and would reach far fewer Users. Thus, cost/effectiveness considerations would be a key factor in choosing between these two illustrative strategies.

We must further note that in most instances, it will *not* be obvious (or even determinable in advanced) what strategy is in fact "best." All sorts of strategy combinations will succeed to some degree. Thus, the Disseminator is not working in an area where he can say there is "one right way." (Of course, there may be clearly identifiable "wrong ways" of Dissemination relative to a particular innovation and a particular User public, and identifying these "wrong ways" may be an important issue for the Disseminator.)

Most likely, an optimal strategy will be to include a variety of approaches; and the specific combination of approaches that should be used will be determined by such factors as: objectives; number and nature of Users; cost; availability of Dissemination resources (e.g., materials, skilled personnel, support equipment such as audio-visual equipment, etc.); etc.

In addition, as we have said, there may be much uncertainty as to the benefits derivable from alternative products. Since products may vary in cost to the User, and there is often also an interaction between the nature of the product and how (and hence at what cost) it can be disseminated, there can be both considerable variation and considerable uncertainty associated with overall cost/effectiveness considerations (where cost is now seen in both User and Disseminator terms).

B. Professionalism and Reliability Factors

Whatever approaches the Disseminator decides to use, it is vital that these be reliable and be used in a professional manner. Sloppy brochures, publications that are not delivered when promised, products and programs that are inappropriate, unclear or unusable--when unprofessional and unreliable Dissemination efforts such as these occur, the immediate and long-term effects can be disastrous for the overall Dissemination process. In the short term, the result is likely to be that the User will give little or no attention to the innovation. In the long term, the result is likely to be that the User will reject out-of-hand any future Dissemination efforts by the Disseminator--whatever the Dissemination strategy.

The basic reason for this dynamic is that the User lives in an *operational* framework. In contrast to the Researcher or the Developer, the User cannot afford the luxury of an iterative process of experiment/improve/experiment/improve/etc.

C. Motivation and Commitment

From the above, it is obvious that the Dissemination process requires a great deal of hard work. Further, the process is subject to a great deal of potential discouragement on the part of the Disseminator. Hence, Dissemination needs to be done by persons and organizations who feel a degree of "excitement" about their task--i.e., those who are interested in and committed to the particular innovation and/or to improvement in the sector as a whole.

D. Trust

An effective Dissemination process is based on trust--trust in the information being disseminated, and trust in the source of Dissemination. Quality control is a key to building and maintaining trust--quality control on the products and quality control on the usage of the products. Simply put, the Disseminator should not be promoting a product under conditions that will lead to its misuse (e.g., under conditions where the User does not know how to use it; or where the product is inappropriate to the User's need).

We may further note that interpersonal mechanisms tend to be seen as more trustworthy than printed and other impersonal mechanisms. This is especially true in areas of innovation where there is a low level of development and a high level of uncertainty.

E. Replicability of Developed Dissemination Media

When considering any particular element of a Dissemination strategy, it is important to make a conceptual distinction between the *design* stage of devising the strategy and the subsequent *operational* stage of using it to achieve the Dissemination objectives. The design stage is likely to take considerable time--deciding what to do, developing it, making it usable through pilot testing, evaluating, refining, etc.

Once the element of Dissemination is ready for use, however, it can generally be reproduced rather rapidly. For instance, the development of the next in a series of brochures is usually a short-term effort. Similarly, training of "detail men" once the pattern has been established tends also to be a relatively short-term effort.

This characteristic of replicability can be utilized in order to expand Dissemination programs rapidly and efficiently. However, in so doing, it is important not to follow the tendency to overuse particular dissemination media simply because it can be done more cheaply and easily.

F. Overall: A Complex Process

Though at times it may appear deceptively simple, Dissemination is a complex process. There will be several steps in the process, and these are likely to be interactive. For example, poor quality control which results in a "bad product" being exposed to a User may negate the best Dissemination strategies. Similarly, unprofessional and unreliable Dissemination efforts will likely result in reduced feedback from the User (relative to the innovation), thus reducing the User information needed by Researchers and Developers.

Thus, while an individual element of the Dissemination process may be relatively simple and manageable, the overall process is complex. There are many different steps in the process. There are many different kinds of Users, Developers, Producers, Intermediaries, Products, etc.

It becomes obvious, then, that designing and managing the Dissemination system requires considerable skill, and this becomes a key issue for the Agency funding and building such a system.

6. Key Problem Areas

From an understanding of the R/D&I process, it is possible to delineate several key generic problems which must be dealt with by the Disseminator if Dissemination is to be effective.

A. Scope of the Problem

1. Size of the User Population

In any sector, there may be a large number of potential Users of innovations. In the education sector in particular, there may be potentially thousands of Users nationwide. Just making effective contact with so many Users is likely to be a significant problem in itself.

2. User (Market) Variations

Within any large User population, it is inevitable that there will be variations among Users. There may even be variations across types of User sub-groups. Further, variations may exist across different facets of User populations and sub-groups. For example, Users may vary according to: needs; location; size; private vs. public status; profit vs. non-profit status; capability to acquire, test, evaluate, implement and utilize innovations; etc. In the education sector in particular, the variations are likely to be quite numerous. Given such variations, several specific problems may arise. For example:

a. It may be difficult to identify which Users are the relevant potential target population for Dissemination of a particular innovation.

b. The needs of the various Users are often hard to identify and define.

c. Market segmentation may be necessary.

B. Producer/User Breakdowns

A second key area for potential problems in Dissemination is the relationship between Producers and Users. We can specify several conditions under which the direct Producer/User relationship is likely to break down.

1. Information Flow

Obviously, the flow of information between Producers and Users is a key element in the Dissemination process. However, this flow of information may be hampered under the following conditions:

a. There are language differences between Producers and Users (e.g., the use of R&D vs. operational language and concepts). For another example, in certain education situations, key Users may be Spanish-speaking, while the Producers are likely to be English-speaking.

b. There is a lack of adequate communication channels between Producers and Users. This is especially likely to be the case when the R/D&I system is immature or where the market (Users) is fragmented and diffuse.

c. Users lack the capability to understand the technical aspects of the innovation. Here, even when the information disseminated is technically adequate and reaches the relevant Users, they may be incapable of using the information received.

2. Producer Motivation

For a variety of reasons, Producers may have a low level of motivation to disseminate new products, especially in the face of resistance, uncertainty and/or fragmented markets.

a. Some Producers may think of themselves simply as Development organizations and may have little interest in carrying out the Dissemination function. In these instances, their organizations may have a low level of Dissemination experience and skill, a fact which will also tend to lessen the motivation to disseminate.

b. Under conditions of perceived resistance, uncertainty or fragmented markets, even those Producer organizations which are oriented towards Dissemination and which therefore have the necessary Dissemination skills may decide that the cost and risk are too high to attempt a high level of Dissemination. An example would be school textbook publishers who might be very hesitant to produce and promote innovative materials which have not yet been "accepted" by Users--or which perhaps have a limited (thin) market.

3. User Motivation

For effective Dissemination to occur between Producers and Users, the Users must be motivated to receive, test, try and evaluate innovations from Producers. A number of factors act as potential barriers to User receptivity.

a. Being exposed to an innovative product can raise the posssibility (to Users) that they are not currently "doing it right," or at least not doing something as well as it might be done. This is not always an easy thing for a User to admit.

b. To study, test, evaluate and then implement and utilize an innovation takes time and is therefore an interruption in the work of Users who may already feel overwhelmed by demands on their time and energy. Where training is required for effective usage, additional demands are placed on the time and energy of the User.

c. The above discussion would seem to imply that Users generally are confronted with a small number of innovations. In many instances, it is more likely that the User will be confronted with a plethora of innovations. When this is the case, the User is likely to feel overwhelmed by a seemingly impossible task of reviewing, testing, evaluating, etc.--and may thus be inclined to ignore everything offered.

A somewhat different issue is involved in those cases where an innovation has been developed by a User. In this case the Dissemination and the completion of the Development process become interwoven. The innovation has to be identified, possibly modified and packaged for a wider User group and then disseminated. A key problem is that there is generally little to motivate a User/Developer to become involved in this process.

4. Skills

a. Producer Dissemination Skills:

Dissemination requires special skills, which may differ according to the type of User and/or the type of innovation. Thus, the Producer/User relationship may break down where:

1) the Producer is inexperienced in Dissemination;
2) the Producer is inexperienced in Dissemination in a particular market or in relation to a particular type of innovation.

b. User Implementation/Utilization Skills:

The Producer/User relationship may also break down when the User lacks the skills necessary for Implementation and Utilization. It is not enough to assume that a "good" product can be effectively used by a User. Training may be required.

c. User Dissemination Skills:

As before, where the User is also the Developer there may be a lack of skills in knowing how to select innovations for Dissemination,how to tailor for general applicability, and how to communicate to relevant others.

5. Supplemental Resources

The Producer/User relationships may also break down when effective Implementation and Utilization require supplemental resources which the Producer does not provide and/or the User does not have (and may not be able to acquire and/or utilize).

6. Patterns of Adoption

The rate of User acceptance and absorption of new information and new information sources tends to be slow. What is important to note here is that the rate of User absorption of new information sources--his awareness of the existence of such sources, his interest in making use of these sources, his trust in these sources, etc.--tends to be much slower than the rate at which these information systems can be developed and made active.

As a result, there is the danger that creating large Dissemination systems may lead to high expectations (by both the Disseminators and the Users), while in reality the benefits and satisfaction may be strongly limited by the slow rates of absorption and utilization.

In a word, the capacity to develop and activate Dissemination mechanisms tends to be greater than User capacity to absorb and utilize the information sent to them by the Dissemination mechanisms. Thus, in designing and creating Dissemination mechanisms, the Agency needs to assess carefully its expectations in terms both of the expected levels and the anticipated time-lines of User Acquisition, Implementation, and Utilization. This assessment also needs to be made by the personnel of the newly-created Dissemination mechanisms.

C. Knowledge about the Dissemination Process

The discussion thus far has focused on various elements of the Dissemination process. Now it is important to note that while much may be known about specific elements of the Dissemination process (e.g., about the impact of written as compared to interpersonal communication), relatively little is known about Dissemination as a complex total process. We must further note that merely "adding up" our knowledge of individual elements will not provide a useful understanding of the Dissemination process, for these parts are interactive and influence and change each other and the overall process.

Given the uncertainty associated with the workings of the total Dissemination process, there is validity in supporting processes of natural development which would lead to the use of mixed and variable strategies in a Dissemination system design. This contrasts with a strategy of seeking optimal designs at this point in time.

7. Design Requirements and Strategies

Up to this point we have been developing an understanding of the R/D&I process. The importance in so doing is to increase our ability to design effective Dissemination systems, develop effective Dissemination strategies, and thereby, to recognize the appropriate Agency role. It is to this task that we now turn our attention.

A. Congruency and Adaptability

A Dissemination system must be congruent with the state of development of the R/D&I system it serves. What is needed (and effective) for an immature R/D&I system may not be needed (or effective) in a mature system. Indeed, the need for some aspects of the system may cease to exist.

Design Requirements:

The Dissemination system design must be flexible and adaptive over time, and even provide for the termination of some of its parts.

Strategy:

Institutions tend to be slow to change and even to resist change. Certainly, it is not typical of an institution to seek its own demise. Thus, an important strategy for a funding agency is to build adaptability (and even termination) into the initial design of the overall Dissemination system, Dissemination sub-systems (e.g., regional D/FF systems), and Dissemination mechanisms.

B. Stability

Though institutionalized Dissemination mechanisms must be adaptive, they must also have stability in order both to avoid dysfunctional disruptions and to benefit from the confidence and competency which comes from experience and familiarity.

When change is abrupt and continual, a number of dysfunctional results tend to occur:

1. Dissemination agents do not have time to accomplish their objectives.

2. Dissemination agents will tend to become uncertain, confused, insecure.
3. Dissemination agents will not gain the confidence and competence that comes from experience and familiarity.
4. Dissemination agents will not have credibility with Users.
5. Users will become confused and will tend to resist further Dissemination efforts.
6. The Disseminator/User relationship will lack continuity.
7. Communication channels will be inadequate and tend to be unknown to the User.

Design Requirement:

The Dissemination system design must provide stability and gradualness to change for the system as a whole and for its parts.

Strategy:

Stability and gradualness of change should both be a part of the initial system design and an integral part of the funding support and programming of the Agency.

C. Management Mode

The nature of the control mechanisms used to manage a system is likely to have a significant effect on the nature and effectiveness of the system. Further, the appropriateness of different management modes depends to a large degree upon the level or state of the system's maturity.

Design Requirements:

1. The mode of management control which is relevant to the current level of maturity of the overall R/D&I system must be built into the Dissemination system design.
2. Provisions must be made in the Dissemination system design for the management mode to change over time as the overall R/D&I system matures.

3. Information feedback mechanisms must be an essential element of the Dissemination system design to provide system managers with indicators of the changing maturity level of the system, and to signal the need for change in the mode of management control used.

Strategies:

In a mature R/D&I system, management of the Dissemination functions normally can be done through the development, use and control of well-developed plans. However, in an immature R/D&I system, this mode of management is not so feasible because there is too much uncertainty, too many variations, etc. Rather, a relevant management mode is one which focuses on policy rather than detailed administrative management of plans--a mode of management which steers and guides the various parts of the system, a mode of management which oversees the process of system development and change.

In this management mode, monitoring of the process becomes they key management tool and a key Agency role whether performed directly or contracted out.

D. Quality Control

As was noted earlier, the quality of innovative products is important to an effective Dissemination process. When product quality is low, User trust in the Dissemination source deteriorates.

Design Requirement:

Mechanisms for quality control of Development/Production outputs to be disseminated must be an integral part of the Dissemination system design.

Strategies:

The Agency role here would be to monitor the quality control process and to intervene to create appropriate mechanisms and processes where these were lacking.

E. The Product/User Match

Regardless of the quality of a given product, it will not be of much value to Users if it is not relevant to their needs or if they are not capable of using it.

Design Requirement:

The Dissemination system design must provide mechanisms through which products may be adequately matched with User needs and capabilities.

Strategies:

Such matching can be accomplished in a variety of ways. For example:

1. proper identification of products relevant to User need and capability;
2. tailoring innovations to User need and capability;
3. helping the User obtain and develop the capability to implement and utilize innovations.

F. Buying/Renting Services

It is not always necessary or wise that every component of a Dissemination system be contained within a single Dissemination organization. Services can be purchased or rented, either temporarily or regularly. For example, successful Dissemination does not depend upon the Dissemination agent doing its own printing. Whether it is more cost/effective to have a printing capability within an organization or to purchase printing services is a valid administrative question, but it is not an issue vital to successful Dissemination.

Design Requirement:

The Dissemination system design must be such as to allow a funding agency to treat the "buy/rent" question as an administrative issue.

Strategies:

The buy-or-rent decision may need to be orchestrated and/or mandated by the Agency.

G. Product Championship

There is evidence from a variety of sources that having a "product champion" is a key factor in increasing the probability of successful Dissemination. The product champion may be a User, a Producer or Developer, an influential individual or group, or even the Disseminating agency. Who the product champion might be can vary. What is important is that the product champion be excited and committed enough to follow through on the Dissemination efforts. We do however note that prior negative User experience with product champions can be a significant barrier to effective utilization of this strategy.

Design Requirement:

None. This is an administrative consideration. The design should neither mandate nor prevent the use of "Product Champions".

Strategy:

For an Agency to become a "champion" may be dangerous. Its role is to ensure that the conditions(incentives, mechanisms) for championship exist in the field.

H. Stimulating User Demand

The likelihood that an innovation will be tried, adopted, implemented, and utilized is significantly increased when there is User interest in and demand for the innovation. Similarly, when a relevant product does not already exist, User interest and demand can be very effective in stimulating the development of a particular innovation.

Design Requirement:

None. This is an administrative consideration. The design should neither mandate nor prevent such a demand effect.

Strategy:

It is often an effective strategy for a Dissemination agent to create conditions which will stimulate User interest in and demand for innovation. When this strategy is utilized, it is important that a funding agency control the rate of such "priming" so as not to permit stimulation of User demands which cannot be satisfied, or cannot be satisfied within a reasonable time frame.

I. The Developmental/Emergent/Experimental Strategy

Since the state of knowledge about Dissemination (as a total complex process) is low, there is justification for pursuing a policy which permits a degree of controlled, natural variation and provides mechanisms for monitoring of natural field experiments.

The justification for such a strategy is three-fold:

1. In conditions of immaturity and uncertainty, it is not obvious which specific mechanisms (or combinations of mechanisms) are most cost/effective (though certainly some building block elements of strategy are more effective than others for certain purposes).
2. Persons in the field may have valid insights about effective Dissemination methods.
3. By using such a strategy, understanding of the Dissemination process in general (and within a specific sector in particular) can be increased and, over time, Dissemination improved.

Design Requirement:

The design must provide mechanisms through which natural field experiments can be monitored and controlled.

Strategies:

1. A funding agency can establish a policy which provides support for natural experiments emerging from activities in the field. When this policy is utilized, it must be accompanied by monitoring and reinforcement.

2. Monitoring is important both to control the process and to learn from the process. Reinforcement is important because there is a premium on doing some things well--excellently--as compared to trying to do many things. To be avoided

are failures due to poor operations which Users then blame on the overall Dissemination system, which in turn produces long-term negative systemic effects. Thus when a particular strategy (or element) is seen to work well, and the capability for performing that strategy has been (or is capable of being) developed, then this strategy should be reinforced.

3. What is to be avoided is the obvious mismatch of strategies to situations.

J. Fail-Safe Mechanisms

In spite of the premium on reinforcing successes and avoiding failures, failures will inevitably occur. There are just too many points of uncertainty and unreliability in the chain connecting R&D to Utilization which in combination result in low success probabilities. Further, when the R/D&I system is immature, the probability of failure becomes quite high. Thus, when the R/D&I system is immature, it becomes imperative that the Dissemination system be designed to be fail-safe. That is to say, if the User experiences failure in one instance, he will be aware that other alternatives are available--as contrasted to the User seeing the Dissemination system as a monolithic system, wherein the whole system is deemed useless by the User when he experiences failure with one part of it.

Design Requirement:

The Dissemination system must be designed so as to provide alternative channels of dissemination to the User.

Strategies:

Strategies should put a premium on redundancy, on making competitive alternatives available to the User. Such redundancy can be achieved in either of two ways:

1. Natural Decentralized Variation and Adaptation: When natural decentralized variation and adaptation are allowed, a variety of alternatives (even redundancy) may become

available to the User, and the User is thus less likely to transfer his perception of weakness in one part of the Dissemination system to the other parts. The various Dissemination mechanisms should, of course, be orchestrated from a higher level, but with a minimum of visibility.

2. A Fail-Safe Centralized System Design: While a fail-safe centralized system design is at least theoretically possible, it is complex and thus very difficult to develop and manage. If attempted, it would include:

a. disaggregated parts;

b. built-in competition among parts;

c. built-in redundancy of a few things done well.

II. DISSEMINATION IN THE EDUCATIONAL CONTEXT

1. Level of Maturity of Educational R/D&I as a Whole

It has been our contention throughout that we must understand an R/D&I system as a whole system in order to develop relevant policies and strategies for any one aspect of the total system. For example, many Dissemination roles and mechanisms which are created for an immature R/D&I system must change over time or even be terminated as the overall R/D&I system reaches maturity.

In education, we find a very immature R/D&I system. There is a history of poor quality products, which suggests the need for internal mechanisms for quality control. There is a history of low levels of User capability in locating and utilizing products, even in defining problems and identifying needs. This history points to the need for intermediate mechanisms to facilitate and develop User capabilities.

Thus, the immature nature of the overall educational R/D&I system strongly points toward the need for intermediate roles, mechanisms and linkages institutions in the educational Dissemination process. However, an understanding of R/D&I systems in general also makes it clear that in designing a Dissemination system for an immature R/D&I system, the design must provide for adaptability, change and even termination of certain Dissemination roles and mechanisms. The importance of designing change into the system is based on the two previously mentioned conflicting considerations.

1. Some Dissemination roles and mechanisms will outlive their relevance and usefulness over time as the total R/D&I system matures.
2. Institutions tend to strive to maintain (and even enlarge) their roles and their existence.

Since such potentially desired "withering away" will not tend to occur naturally (or easily), the mandating of design for change (e.g., timed funding) and the necessary monitoring become key Agency roles.

2. User Setting

If workable Dissemination strategies are to be developed and effective Dissemination systems to be designed, problems inherent in two characteristics of the User system must be taken into account: a) its enormous scale, and b) the attitudes toward change likely to be encountered in User settings.

A. Scale

1. An Enormous Number of Users

There are more than 19,000 LEA's in this country. Each one includes many schools (literally hundreds of schools in the larger cities). In each school there are numerous teachers--not to mention students (who are in a real sense the ultimate Users). Thus, any idea about designing a Dissemination system to reach an entire universe of potential Users is simply mind-boggling, especially given limited federal resources allocated to the education sector.

2. A Tremendous Diversity and Variety Among Users

As might be expected with such an enormous number of Users, there is a tremendous amount of diversity and variety among Users. There are: rich and poor Districts; urban, suburban, and rural Districts; public and private educational systems; large schools and small schools; Districts with a high level of teacher professionalism and Districts with a much lower level of teacher professionalism; etc.--not to mention variations in educational philosophy and in the nature and extent of administrative leadership.

From the product perspective, there are many kinds of products for which there is a relatively thin (and not commercially profitable) market--a fact which may point to a need to develop special mechanisms for disseminating thin market products.

Given the problems of scale, it would seem reasonable in developing Dissemination strategies and mechanisms to: a) identify the categories of personnel in different kinds of User settings who have the most impact on Adoption decisions, and b) focus Dissemination strategies and resources on these target Users. One possibility might be to differentiate LEAs in terms of the professionalism of their instructional personnel. The educational change literature is rather inconsistent in assessing the relative influence of teachers vs. principals and other administrators on innovation Adoption decisions (a matter rather different from innovation Implementation). Some analysts emphasize the need for participative decisionmaking on the Selection and Adoption of new programs, products, etc., with a major (perhaps the major) role for teachers. Other analysts urge strong administrative leadership as a preferred alternative, describing the real influence of teachers on such decisions as minimal and over-rated--and seem to suggest that this minimal role for teachers is to be viewed as desirable if innovation is to occur. What seems missing from these analyses is consideration of such factors as the professinalism of a District's teaching staff as a determinant of the appropriateness of one or the other of these approaches. Thus, for those Districts where the instructional staff demonstrates a high level of professionalism, the appropriate Dissemination strategy would seem to be to target Dissemination resources directly at teachers. In those Districts where the instructional staff demonstrates a considerably lesser degree of professionalism, the target for Dissemination could be Superintendents, principals, and other administrators--on the assumption that the teachers are likely to "go along with" the administrator's decision. Given the limited resources available for Dissemination, it might be wise to further segment the Districts with relatively low teacher professionalism into those characterized by strong vs. weak administrative leadership and more vs. less interest in innovation and work primarily with those Districts demonstrating interest in innovation and strong administrative leadership to promote and support innovation.

At times, effective Dissemination may require a strategy of selectivity in the choice of User target groups with which to work. For example, in a diffusion model of Dissemination, the Disseminator might work with only a few selected User groups. To consider another example, given limited funding, it may be best not to try to work with a resisting SEA. However, there is a danger that this kind of choice will be made simply on the basis of convenience. Thus, it may be necessary and appropriate for an Agency to mandate allocations of effort and to make available to Disseminators information on preferred strategies.

B. Motivation and Technical Capability

Resistance to innovation is probably the single most salient characteristic of User settings described in the change literature--not only in education but in other sectors as well. In any given instance, such resistance may be attributable to attitudes, norms, and User system constraints; or to technical complexities and difficulties that make effective Implementation beyond the capabilities of User personnel in the absence of Implementation supports that are not provided; or both (as when awareness of the technical complexities generate resistant attitudes).

The attitudinal basis for resistance is simply that change tends to be threatening to people. In the education sector, the "threat" aspect of change is probably even more significant because educational innovation involves people change: new behaviors; philosophy change; technical strategies which require teachers to unlearn "old" behaviors and strategies with which they are familiar; etc.

However, there is suggestive evidence that the attitudinal dimension may well have been given excessive stress in the literature and that the technical problems may in the long run have far greater significance for determining the fate of innovations than the attitudinal ones. More often than not, teachers appear to be willing to give an innovative idea or program a try. But very often, the programs fail because no one has given the teacher needed technical support--the kind of Implementation support and technical assistance that is required to make an innovation successful. The result is failure--failures which make it difficult to introduce the next innovation into that particular school system. Thus the ensuring of proper quality control and technical support components in Dissemination programs would seem to be of central importance.

There has been increasing recognition of the importance of the technical side of resistance. Thus we find Dissemination and Utilization being clustered or integrated in recent educational policy. There is validity to this clustering of the Dissemination and Utilization functions. That is to say, it is not enough just to disseminate information and make Users "aware" of an innovation. The User must also have, be able to obtain, or be provided, Implementation/Utilization support throughout the Adoption/Installation process in order to make sure that there is the best possible chance for the innovation to be successful. Otherwise, the probability of Dissemination failure is very large--with the attendant result that Dissemination efforts and money spent will be wasted and that resistance to future Dissemination will develop.

3. Climate

At least two major factors have tended to create a very poor climate for Dissemination in the education sector. One factor has been the lack of Implementation/Utilization support to the User during the Dissemination process. (This we have already discussed above.) Another factor is that many products disseminated to school Districts have been of poor quality--at least some have been clearly inferior to existing User-developed practices, programs, materials, etc. The effect of such Dissemination has been to create negative attitudes toward the R&D system and its outputs and also a lack of trust in both the information and outputs disseminated and the sources of Dissemination information. Under such conditions, many Users have become skeptical of any innovation. Further, there has developed an attitude that anyone advocating a product is doing so for his own benefit or glorification. Finally, the professionalism with which the Dissemination was pursued left much to be desired.

Thus, past Dissemination efforts have created a poor climate for Dissemination, a climate which makes it more difficult for new Dissemination efforts to have significant impact.

The point to be made in reference to current and future Dissemination policy and strategy is that:

a. User trust in the source of Dissemination is vital.

b. To develop and maintain this trust, it is vital to do well whatever is done--both in terms of the product and the Dissemination efforts.

Perhaps this is an important part of the reason why commercial products are so dominant in school systems. Even though commercial products tend not to be the outputs of rigorous, systematic R&D, and not to have been carefully tested, the commercial firms do a very professional job of marketing and distributing their products. It would seem to be the responsibility of NIE to ensure that similar care and professionalism is built into the Dissemination systems it helps to create.

4. Numerous but Fragmented Dissemination Efforts

In the education sector, there has been a considerable amount of activity that has been called Dissemination. But still, despite all this apparent activity there seems to be widespread disappointment in what is perceived to be rather minimal impact on school practices and programs. Relatively few R&D outputs produced by the specialized Development organizations appear to have been adopted (or if adopted, maintained) by the User system. Where innovative practices can be identified in a school system, they tend more often than not to take the form of locally developed exemplary practices or programs that are lost to the larger system for lack of packaging and dissemination. Therefore, despite all the activity that is categorized under the Dissemination rubric, there appears to have been relatively little effective Dissemination. Dissemination programs do not appear to have been noticeably successful in achieving their objectives.

There would seem to be several possible explanations for this limited impact. But certainly one factor that accounts for the weakness of the Dissemination function in education is its fragmented, scattered character. Of the several types of Dissemination activity in education that could be noted to underscore this point, two in particular illustrate the point well.

1. Development "Add-Ons": Particularly in the early years of federal funding of the regional laboratories and R&D centers, Dissemination was assumed to be an activity that should be carried on by each Developer, to make potential Users aware of and interested in implementing the Developer's own products and programs. In each case, a certain amount of the total funding was set aside for Dissemination. Such Dissemination "add-ons" tacked onto grants or contracts for Development work appear to be one of the dominant modes of Dissemination funding in the early and late '60s. Such Dissemination was rarely if

ever carried out by specialized personnel, mechanisms, or units with the kinds of training, backgrounds or organizational supports that would suggest a strong likelihood of success in achieving Dissemination objectives.

2. Dissemination Channels within Categorical Programs: Stronger Dissemination efforts with some greater degree of success were (and continue to be) found within the domains of the various kinds of federally-funded categorical programs (e.g., special education, handicapped education, vocational/occupational/career/educations, ESEA Titles I and III, etc.). However, each of the categorical programs appears to have developed its own, discrete specialized Dissemination system, separate and apart from any other program--its own channels, mechanisms, etc. Even if a potential User learns his way around the Dissemination system of a given categorical program to meet one specific set of needs, he is likely to still be totally in the dark about the Dissemination channels potentially able to assist him in meeting a different set of needs subsumed under a different categorical program.

From the perspective of the potential User, then, there may be a multiplicity of potential Dissemination channels that might serve him, but he is likely to be only vaguely aware of some, totally unaware of others, and too engrossed in his day-to-day operational problems to invest substantial time and energies in taking the initiative to cut through the morass.

Federal agencies have become increasingly cognizant of this problem. The history of the OE/NIE response over the past decade warrants some analysis if policies are to be developed that take into account the educational context as it appears today and the various assumptions that have shaped that context in the past and may continue (in varying degrees) to do do today.

5. Recent Federal and State Initiatives in Dissemination

A. Three Modes of Dissemination

Federal Dissemination policy over the past decade or so has gone through three identifiable emphases: first, an emphasis on the creation of a centralized, comprehensive resource base through which Users could gain easy access to needed information; a second focus on supporting product advocacy efforts designed to persuade Users to adopt specific outputs of the R&D system; and finally, a shift in emphasis to advocacy of change processes rather than particular products, with accompanying provision of needed supports for the change process.

1. Creation of a Comprehensive Resource Base

In the 1960s, federal policymakers came increasingly to recognize the scattered, fragmented character of Dissemination in education and the difficulty of locating information relevant to a vast array of potential needs, stored in innumerable discrete repositories (or not stored at all). The solution to these problems seemed to be to create a single, centralized, comprehensive, generalized (rather than specialized) resource base that would meet any User's needs--i.e., to place all the scattered resource information in a central repository through which, by the push of a button, the User would have immediate, automated access to every item of information available about his specified need.

Thus, the massive ERIC system was created by OE to acquire, store, abstract, and provide easy computerized retrieval of sources from the extensive, unpublished, "fugitive" literature of the education sector. ERIC also provided publications that announced acquisitions to the field (and therefore were expected to make them more visible), indexed the journal literature of the field as well as the fugitive literature stored in the ERIC collection, and provided several hundred information analysis products that synthesized information in selected topical areas.

Several characteristics of ERIC should be underscored:

a. ERIC was primarily a repository for Research information.

b. ERIC provided a single, generalized Dissemination capacity. It was not comprised of separate, specialized systems targetted at different User groups or focused on different problem areas or needs.

c. ERIC was a passive system. It was a passive information repository that required User initiative to activate it, and therefore assumed User capacity to define their information needs, to learn the descriptors, and other tools required to make effective use of the ERIC system, and to screen and make use of the enormous quantity of (not always useful or high quality) output the system provided.

We shall return to the implications of these points later in this analysis.

2. Product Advocacy

While ERIC was being developed and expanded, a somewhat different Dissemination strategy was evolving and being promoted with federal funding. The annual budgets of the federally-funded regional laboratories and R&D centers included specific allocations for Dissemination programs, especially those involving dissemination of the R&D outputs they were producing. Various institutions and mechanisms were created specifically to advocate the use of particular products or programs they selected or developed, and to persuade Users of their merits--

e.g., the Instructional Materials Centers, and Title III demonstration centers.

Over time, however, some difficulties in the product advocacy mode of Dissemination became apparent. Many of the products disseminated were of poor quality and were overzealously "marketed" by Disseminators functioning as advocates. And too, much of the Dissemination effort carried out in this mode was amateurish in nature--it lacked polish and professionalism. These two factors together--poor quality products and weak Dissemination programs--contributed to an already negative set of User attitudes toward the R&D system as a whole.

3. Change Process Advocacy

NIE's policies appear to have shifted some of the emphasis in federal Dissemination efforts away from the product advocacy mode to an advocacy strategy that provides supports for change processes and innovation in schools as a more general phenomenon. Instead of advocating particular products, strategies have been developed to: a) provide Users with information about the full array of products, programs, information sources, exemplary practices, etc. available to meet a given need--comparative evaluating information on the alternatives where possible--while b) developing the User's capabilities for identifying needs and evaluating, selecting, adapting and implementing the products of his choice. The emphasis is twofold: building User system capabilities and increasing the "rationality" (in the technical rather than the layman's sense) of Users' decisionmaking processes. The State and federal Dissemination agencies that carry out this strategy provide information and supports that make it easier for Users to plan and implement changes (if they want to).

Decisions on whether or not and how to change remain with the User.

B. Some Specific Current Strategy Developments

Several aspects of current NIE Dissemination strategy warrant mention.

1. Centralized Resource Base: The Expansion of ERIC

ERIC was designed initially as a resource base of Research information. In more recent years, several initiatives have expanded ERIC into an informaton base for accessing a wider array of resources to meet User needs: R&D products and descriptive product information packages; exemplary practices from the User system; Research and policy interpretations and syntheses; guides, catalogs, product inventories, etc.--all input in a form compatible with the automated ERIC retrieval system. For those practitioners who make use of the system, the kinds of resources that have become accessible have broadened in scope.

2. The States and Intermediate Dissemination Mechanisms

NIE's Dissemination policies have placed a great deal of emphasis on working with and through SEAs and LEAs. The federal role is seen as one of facilitating, coordinating, and providing seed money to mobilize State and local Dissemination resources and to build needed Dissemination/Utilization capabilities in the SEAs and LEAs.

Given the scale and variability within the User system in education, and the rather limited financial resources of NIE, there is simply no way for the Institute to directly impact the User system effectively and significantly. SEAs have substantial resource bases to apply to the Dissemination function, and in recent years a number of SEAs have exercised strong leadership in: developing systems for needs assessment and long-range planning; identifying and disseminating exemplary practices; and providing information services and technical assistant to local school systems. NIE's strategy is designed to support and strengthen the States in these efforts--to provide seed money to facilitate and expand what they are currently doing, and to facilitate and expand their capacity to do what they are doing more effectively so as to be able to coordinate education Dissemination activities.

The pooling of federal and State Dissemination resources is expected to increase the potential payoff of the federal investment. The strategy is expected to be more cost/effective in the long run, and probably more effective in impact regardless of costs because of the added possibilities of providing services through the States that are tailored more adequately to local District needs.

3. More Active Dissemination/Utilization Stategies

NIE's State Dissemination Capacity-Building Grants have been used in general to establish (or strengthen) variants of a model that includes: a) a centralized resource base providing access to the ERIC system and perhaps other State resource bases; and b) a network of field-based, specially trained Dissemination agents (or "educational extension agents," or "information agents") who function as active, personalized Dissemination links between the resource base and the User. The various States that have created such systems differ in how they define the role of the extension agent; what services they provide; who they are; where they are placed (e.g., in regional-type education information centers or in the Districts themselves); etc. But regardless of which variant is used, the extension agent concept adds two elements to the Dissemination process:

a. There is now an intermediate-level link to facilitate

User access to the centralized resource base.

b. This new intermediate link is an active link. The extension agent works with the User to define problems and needs. Information and materials potentially useful for meeting these needs are retrieved from the resource base, screened, synthesized, and transformed into information packages tailored to the User's needs and constraints. Follow-up supports and feedback mechanisms also tend to be built into the system designs. In some of the most active models, the extension agent may even function to persuade the User of the need for change, and perhaps even provide technical assistance to support the planning and implementation of the proposed changes. (In addition to the technical assistance capability that may be built into some of these State systems, some of the newer NIE initiatives such as the R&D Utilization Program provide the beginnings of a developing technical assistance capability.)

We might note that all of these more recent strategies result from a system-level kind of thinking and that they are essentially procured to facilitate User access to the information resource base.

4. Two-Way Communication

Recent federal Dissemination policy statements have tended to underscore a view of the Dissemination process as essentially two-way rather than one-way communication. The assumption here is that if Dissemination efforts are to be effective in achieving widescale Implementation and Utilization of Development outputs, more will be needed than simply setting into motion one-way flows of outputs from Producers/Suppliers to Users. In addition, it is now argued, information from Users will have to be fed back into the system--User perceptions of their problems and needs, of the quality and effectiveness of products that are being disseminated, and of the strengths and weaknesses of the Dissemination strategies and mechanisms being used. Thus, one of the most recent NIE initiatives to strengthen the Dissemination function in education is the planning of a system currently referred to as the Dissemination/Feed-Forward system.

C. A Note of Caution

The newest NIE Dissemination program--the planning of a Dissemination/Feed-Forward (D/FF) system--suggests that an additional "regional" level of Dissemination mechanisms is about to appear on the multi-level scene of local, intermediate, State, interstate, and federal agencies and organizations. Although still in its early planning stages, it appears that one purpose of the new regional system will be to somehow coordinate "everything" relevant to Dissemination and Utilization that is taking place within a given region. The coordination intent here would seem to be to make the various discrete, perhaps scattered communication channels and resources in an area more accessible to the User.

There is a potential danger here, one to which we have already referred. Certain types of coordination and integration may indeed need to occur. But if there is too much "coordination," redundancy may be eliminated--and with redunancy, some of the competitive alternatives available to the User will be eliminated.

Given the likelihood of failure in the education Dissemination system (as we noted earlier), the Dissemination system needs to be made fail-safe. NIE should not create a single, exclusive, intermediate Dissemination channel to link into a given User setting. If all User information in a region must channel through a regional agency and the regional agency fails or is ineffective with the User, then there is the potential that the whole Dissemination system may be viewed as useless because the User has no palatable alternatives.

If such regional agencies have to be developed (for political or other rational reasons of regional needs and opportunities), then this system should be designed in a way that does not eliminate diversity, does not result in too much standardization, does not eliminate alternative information access channels. A possible solution might be to take the "regional opportunity" to create instead, an alternative system to that pursued by the States, but working in coordination with them.

The orchestration and coordination which is necessary in upper levels of the Dissemination system (i.e., in the Agency) needs to be subtle. To achieve such subtle yet effective orchestration and coordination is difficult because the natural tendency is to overcoordinate and overmanage--a tendency that can kill off the very diversity that is the essence of a fail-safe system design. NIE will need to be actively involved (and very well informed as to the critical issues and impacts) in the system design and functioning.

6. Personnel Base

We noted earlier how critical it is for Dissemination strategies to be carried out in a highly professional manner. In education, however, a well developed personnel base of trained Dissemination specialists is lacking. Most of those carrying out Dissemination activities appear to be practitioners by training. They are proceeding intuitively and learning their jobs through hard, often unsuccessful, experience. Several federally funded programs have been developed in recent years for training D&U (Dissemination and Utilization) specialists. Dissemination mechanisms, however, are expanding far more rapidly and creating a far greater demand for trained personnel than these programs could ever hope to keep up with. This problem suggests policy options in need of consideration--e.g., expanding the training capability and the size of training programs to meet the demand for trained D&U personnel, or slowing the rate of Dissemination system expansion.

If NIE decides on a policy of facilitating as rapid an expansion of the personnel base as possible--to meet the anticipated expansion rate of the Dissemination/Utilization function--the Institute may have to consider developing recruitment incentives as well as supporting expansion of the D&U training capability. In this regard, two points can be suggested:

a. Personnel with classroom and school system backgrounds may be particularly well suited for D&U positions. They are likely to be sensitive to User needs and constraints, are likely to interact well with Users, and, in comparison to many others who might be recruited for these positions, are more likely to view this work as important and exciting. An additional consideration here would seem to be the large reservoir of such talent available in the sizeable teacher population currently unemployed.

b. The other likely source for recruitment would seem to be persons trained and employed in universities. However, there would seem to be a strong likelihood that such persons would be oriented more toward an R&D perspective than the User viewpoint, would be less sensitive to User needs and constraints, less effective in interacting with Users, and less likely to find D&U work appealing or exciting. Clearly, there are bound to be exceptions, and talented Dissemination agents may be recruited from a wide range of settings. But if recruitment efforts are to be adequately focused and concentrated, choices will have to be made about where the strongest payoff is likely to be. To meet this need, we would suggest the User setting as the most appropriate focus for recruitment efforts.

7. The Institutional Base

Within the education sector, one finds an enormous number and diversity of organizations involved in carrying out work relevant to Dissemination and Utilization. These organizations will have to be taken into account, facilitated, and monitored if the Dissemination function in the education system is to be effective.

The enormity and complexity of this institutional base for Dissemination can be seen by simply developing a list of such organizations. For example:

1. All Producers
2. Commercial firms
3. Regional laboratories and R&D centers
4. Federally funded programs having a Dissemination component
5. SEAs and ISAs (Intermediate Service Agencies)
6. Foundations and universities to some degree (perhaps not very effectively, and usually in print form)
7. Consortia of various types
8. Networks of Users (usually created by the producer of a specific product)
9. Recent NIE funded programs which have created various technical assistance mechanisms
10. Various sorts of organizations that are focusing on R&D Utilization (e.g.: Developers/Users; SEAs/Users; User/User; etc.)

These multitudinous and varied organizations must be taken into account simply because they are part of the Dissemination system, even if they are not all part of the system created by the federal government. As in connection with various other aspects of the R/D&I system, NIE may have to accept the initiating role in orchestrating this diverse but relevant community, especially if NIE follows (as it should) a strategy of building, as feasible, on what already exists in the field.

III. IMPLICATIONS FOR AGENCY BEHAVIOR

1. Procurement Behavior

A. Orchestration as Main NIE Role

Given the immaturity of the educational R/D&I system, the large scale and variability of the User System, and the fragmented nature of current Dissemination efforts, the key role for NIE would seem to be one of system orchestration. These very characteristics call for some degree of higher (i.e., federal Agency) level orchestration. Beyond this, Dissemination is a systems function and can be managed only at an overall systems level. Although OE clearly has some responsibilities in carrying out the Dissemination function in education, NIE is the lead Agency for Research and Development in education and is more likely to view R/D&I functions in interrelated systems terms. Close coordination with OE will undoubtedly be needed. But if NIE is to carry out its legislative mandates to both "build an effective R&D system" and "improve practice," NIE leadership in carrying out the orchestration role will clearly be necessary.

This kind of orchestration required by the education sector's immature, large and fragmented Dissemination system must be carried out in a proactive (as compared to a reactive or passive) mode. Orchestration requires an active posture--it will not happen if the Agency takes a passive stance; and it is likely to take dysfunctional form if the Agency behaves in a reactive manner.

At the outset, Agency planning must be based on a clear understanding of what already exists in the field--what is being disseminated; by whom; to whom; how well; and with what degree of success as measured by User system Adoption, Implementation, and long-term Utilization/Maintenance. Some of this information already exists--in scattered sources, reports, and in people's heads (and files) across the multi-level federal, State, intermediate and local system. Some of it is being gathered in the current D/FF system planning effort. However this information is gathered--from contracted studies and analyses, through field input, as an outcome of the creation and orchestration of a State/regional/national organizational mechanism for Dissemination coordination--it must then be used by the Agency, taking a somewhat directive approach initially, to make decisions (with field guidance and advice) as to directions, objectives, etc. for Agency orchestration of system facilitation and system building. Given the long-term system-building concerns of the Institute, orchestration will have to take on one additional dimension--i.e., balancing coordination of current system needs with long-term system-building requirements.

B. System Facilitation and System Building

Throughout our analysis, we have emphasized system facilitation and system building as the two overriding objectives of NIE Dissemination policy. In the short term, the basic need would seem to be: a) to facilitate existing Dissemination efforts and activities; and b) to fill "gaps" in the system, either by creating new institutions, roles, and mechanisms or by renting services. Over the long run, the need is clearly one of system building.

NIE-initiated system design must be congruent with the state of the overall Dissemination system (and the educational R/D&I system more broadly). Currently, this means facilitation and gap-filling. Over time, this means building into the system the capability to adapt, change and even terminate component parts as the overall system matures.

If the system is to function effectively, it must be managed in a way that avoids dysfunctional disruptions and permits Dissemination agents to gain the confidence and competency which come from experience and familiarity. Consequently, what is needed is both stability and change. To remain congruent with overall system maturity over time, NIE-initiated Dissemination mechanisms must change. Still, a system must have enough stability to permit it to carry out its functions effectively--to build trust, to avoid confusion, etc. Thus, stability too must be built into the system design, and must be monitored and attended to with great care.

C. Process Mode of Management Control

With regard to the Dissemination function (in contrast, for instance, to Research) we have suggested that NIE must be directive in carrying out substantial portions of its overall role. Whether to control is not the issue. Rather the issue is what to control. And here, we have focused on the process mode of managment as most appropriate.

Where the overall system is weak and varied, only the process mode of management would seem to be feasible. Where the overall system is strong, only the process mode is needed. Currently, then, the mixture needed would seem to be one of:

a. process control over weak areas of system functioning;
b. process control through collaborative coordination where strong Dissemination agencies exist.

D. Linkages/Transforms

We have noted repeatedly throughout our analysis how weak the linkages (or transforms) are between stages of the R/D&I process in education. Given the weakness of the knowledge and technology base of the field, it is not entirely clear how to transform Research findings into Development products (or even how to transform the accumulating Development state of the art into Development products); how quality control is to be applied to Development outputs; how Development outputs are to be disseminated to Users;

how disseminated products are to be used; or even how to translate User problems and needs into researchable questions or Development product specifications or Dissemination/Utilization strategy specifications.

These weak linkages or transforms must become a major focus of Agency attention if the field's knowledge/technology base and its R/D&I system are to mature. With regard to the Dissemination function, this suggests the need for focused effort on:

a. designing quality control mechanisms for screening Research and Development outputs prior to their dissemination;

b. improving the design of Dissemination mechanisms and strategies through funding analyses of the requirements for optimizing User/product/Dissemination strategy "fits";

c. strengthening the Dissemination/Utilization linkage through funding analyses of D&U requirements for given product and User types and perhaps too documentation-and-analysis Research on naturally occurring variation or planned variation experiments in different patterns of D&U activity;

d. design of Researcher/User and Developer/User linkage mechanisms that might strengthen the transforms between User needs, problems, preferences, and constraints, on the one hand, and, on the other hand, initial Need Identification for a given Problem-Focused Research project, ongoing Need Identification (and User/Product "fit") over the course of Development projects, and the design and implementation of Dissemination/Utilization strategies.

E. Use of Mixed Strategies

Since the state of knowledge about Dissemination (as a total complex process) is low, it seems most appropriate for the Agency to pursue a policy which:

a. permits a substantial degree of controlled, natural variation; and

b. provides mechanisms for monitoring natural field experiments and building-in documentation-and-analysis types of Research projects to enable us to develop a cumulative knowledge/technology base from these experiments.

In addition, given the uncertainty and unreliability of our understanding of D&U processes at this time, and the strong probability of a significant number of failures, it seems essential to provide Users with alternative channels of access to the available resource base. Consequently, we have emphasized the need for:

a. decentralized rather than monolithic, centralized, "over-coordinated" approaches; and

b. fail-safe system designs that permit a substantial amount of redundancy.

Furthermore, given the significant amount of variation in both products and Dissemination modes in education, there would seem to be additional support for an overall Agency orientation toward supporting a range of alternatives as well as combinations (i.e., mixed strategies).

F. Control Growth and Expansion Rates

Since the Dissemination system can be built at a faster rate than User ability to Adopt, Implement, and Utilize what is disseminated, we have underscored the danger in creating and/or expanding Dissemination systems too quickly. Since such large and expensive systems are likely to generate unrealistic expectations by Users, Congress, and NIE of immediate and widescale benefits, the size and expansion rates of NIE-sponsored Dissemination systems must be controlled carefully. Such systems should be no larger, and should be expanded no more rapidly, than is congruent with insuring:

a. adequate quality control of outputs disseminated;
b. needed technical support to increase the likelihood of User success with disseminated outputs;
c. a high level of professionalism in all Dissemination efforts; and
d. adequate recruitment and training capabilities to permit the trained personnel base to expand at a rate congruent with the rate of system expansion.

G. Monitoring

If NIE is to effectively carry out its orchestration role, and is to manage the system wherever possible through feedback and field guidance, the Agency must put into place a carefully designed monitoring system, with monitoring indicators keyed to the kinds of pitfalls in system design and implementation we have suggested. The monitoring system must be designed well. And it must be used in an ongoing, routinized manner to insure continual monitoring, feedback, and adaptation--the virtually imperceptible kinds of minor "fine-tuning" adaptations, rather than the reactive dysfunctionally major system modifications more likely to be the outcome of episodic, discontinous, only occasional monitoring.

H. Mandatable Features

There are several aspects of Dissemination functioning which NIE should feel reasonably free to mandate in a somewhat directive manner. For example:

a. NIE might mandate specific allocations of efforts to particular thin market products or to dissemination to meet the needs of specific groups not well served by existing mechanisms.
b. It would probably be unwise for NIE to mandate the dis-

semination of specific products. But it would seem perfectly reasonable for NIE to facilitate, or even mandate, the creation of conditions (incentives, mechanisms) that would make it possible for, or even encourage, Producers or Users to become Product Champions for products of their choice.

c. While the decision to buy or rent services may be an administrative matter, conditions that would make "renting" a feasible option in certain cases may need to be facilitated. This facilitation may require some Agency orchestration or even mandating.

d. NIE might mandate certain decisions as to who is to function as the Disseminator for a given NIE-sponsored project--e.g., whether a given product is to be disseminated by its Developer/Producer or by some specialized Dissemination mechanism.

2. NIE Skills Required

We have made a number of points throughout this analysis that suggest the need for NIE to possess and to exercise great skill in its management of the Dissemination function. We have underscored the considerable complexity of Dissemination as a total process, regardless of the particular sector in which it is carried out. And we have noted how the multiplicity of institutional bases for Dissemination in the education context, as well as the multiple levels of government involved, complicates that picture manifold for NIE. What the Institute needs, then, is extensive familiarity with what exists now, and how well it works, as well as some rather clear notions about the directions it might take in system facilitation and system building.

NIE staff will need to draw on a high level of professionalism on matters affecting Dissemination system functioning. This professionalism must come from its own internal staff capabilities and the capabilities it rents from various consultants drawn from academic, R&D,

and User (SEA/ISA/LEA) settings.

Of all the kinds of skills Agency personnel must have to carry out NIE's role in the Dissemination system most complex of all are the kinds of subtle management skills required of personnel who must function as "hands-off" planners--subtly, almost imperceptibly coordinating and orchestrating at a higher level a system that is highly decentralized and redundant and that is performing a critical system linkage role in an immature R/D&I system in which most of the parts to be linked are weak and underdeveloped. We do not mean to suggest that this will be anything other than an incredibly difficult, almost impossible task requiring skills that probably do not as yet exist--within the Agency or outside.

Still, if our analysis is accepted, this is the Agency role required and these would seem to be the kinds of Agency management skills to be developed. How such skills might be developed is another matter, outside the scope of this analysis. Clearly, though, if NIE is to function in the manner we have suggested, the matter would seem to be one that merits some attention.

EVALUATION RESEARCH

I. THE NATURE OF EVALUATION RESEARCH

1. Defining Evaluation Research
   A. Evaluation Research: Evaluation and Research
   B. A Unique Function: Knowledge Production and Knowledge Utilization Characteristics
2. Two Types of Evaluation Research: Formative and Summative
   A. Formative Evaluation Research
   B. Summative Evaluation Research
   C. A Research Dilemma
   D. The Same or Different Evaluation Researchers?
3. Three Purposes of Evaluation Research
   A. For Policy Makers and Funders
   B. For Program Administrators
   C. Knowledge Production
4. The Conflict Potential Among Significant Participants
5. A Real Life Context
6. The Program Focus of Evaluation Research
   A. A Specific Focus
   B. Program Goals
   C. Program Complexity
   D. The Changing Nature of Programs
   E. Research Skills: A Methodological Issue
7. Key Characteristics of the Evaluation Research Function
   A. The Technology Base: Design and Methodologies
   B. Purposes
   C. Problem Definition
   D. Clear Targets
   E. Time Frame Constraints
   F. Tight Management
   G. Modest Approaches

II. EVALUATION RESEARCH IN EDUCATION: A SOCIAL SCIENCE CONTEXT

Introduction: A Social Science Context
1. Historical Development of the Evaluation Research Function
2. A History of Methodological Issues
3. The Knowledge/Technology Base
4. The Study of Social Change: A Serious Dilemma
5. The Personnel/Institutional Base
6. A Value-Laden Political Context
7. Control Over Outcome
8. The Educational Context
   A. Design Variations
   B. Multiple Levels of Government
   C. Awareness of Formative/Summative Evaluation Research Issues

III. IMPLICATIONS FOR NIE ROLE

1. Orchestration as the Major NIE Role
2. Formative and Summative Evaluation Research
3. Differing Information Needs
4. The Political Context
5. Problem Definition
6. Are Evaluation Research Findings "Public" Data?
7. Interim Reporting
8. Staging
    - A. The Design Stage
    - B. The Data Collection Stage
    - C. The Data Analysis and Reanalysis Stages
    - D. Formative and Summative Evaluation Research
9. Portfolio Effects on System Capability Building
10. Monitoring and Tight Management
11. Internal NIE Considerations
    - A. Relation of NIE to the Field
    - B. NIE Personnel

EVALUATION RESEARCH

I. THE NATURE OF EVALUATION RESEARCH

1. Defining Evaluation Research

A. Evaluation Research: Evaluation and Research

We must note at the beginning of this functional analysis that we have chosen to use the term "Evaluation Research" instead of the more common term "Evaluation". We think this is an important distinction. The term "Evaluation" leads one to focus on the process of analysis and interpretation. While this is indeed probably the typical understanding of this function, such an understanding is seriously flawed. "Analysis" and "interpretation" require a data base that can be obtained only by some form of Research process. Thus, this function must be understood as being an interactive combination of Evaluation and Research -- thus our choice of the term "Evaluation Research".

B. A Unique Function: Knowledge Production and Knowledge Utilization Characteristics

The Evaluation Research function is a somewhat unique function. On the one hand, as Research it will tend to have characteristics normally associated with the Knowledge Production end of the innovation process. On the other hand, because Evaluation Research is usually carried out for the benefit of Users (administrators and policy makers) and because Evaluation Research cannot (by definition) be performed until after knowledge has been utilized, Evaluation Research will tend to have characteristics normally associated with the Knowledge Utilization end of the innovation process.

Figure 4 illustrates the KP/KU nature of Evaluation Research. Figure 4 also indicates that there are different types and purposes of Evaluation Research (as we shall note later). Because this unique combination of KP/KU characteristics underlies many of the tensions associated with the Evaluation Research function, it is vital that this be understood.

2. Two Types of Evaluation Research: Formative and Summative

For many analytical purposes it has been thought useful to see Evaluation Research as having two basic forms (though we realize there is some overlap).

A. Formative Evaluation Research

Evaluation Research findings may be generated at intervals during the life of the program in order to provide a monitoring/self-correcting function. As the program will not have been completed, formative Evaluation Research findings must be considered to be tentative -- but they are nonetheless important to program administrators. Their function must be seen primarily as part of the program administrator's or developer's team. Seen this way, as helpers and not information sources for external evaluators, formative Evaluation Researchers need not (should not) pose a threat to program personnel.

B. Summative Evaluation Research

The basic purpose of summative Evaluation Research is to determine the effects of a program through some form of pre/post or time-series or similar types of analysis. In this case, findings are generated after the completion of a program (or at least, for ongoing or long-term programs, after the program has been in existence for a sufficiently lengthy period of time to permit pre/post analysis).

This pre/post summative Evaluation Research may be performed in order to determine how well a program has met its objectives and/or to provide a cost/benefit analysis. The change-detecting summative evaluation may also be done simply to identify and understand the effects of a program, apart from program objectives and cost/benefit considerations. For whatever reason it is carried out, summative Evaluation Research involves measurement aimed at detecting changes or impacts attributable to the program.

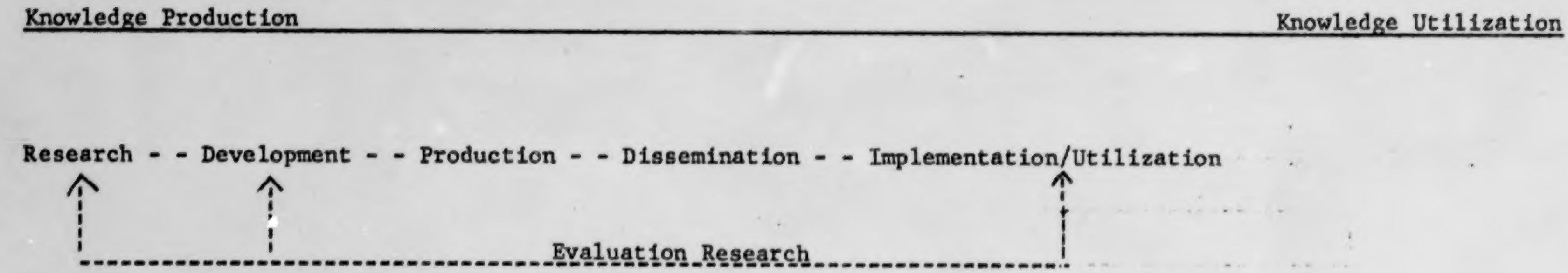

Knowledge Production
Knowledge Utilization
Research - - Development - - Production - - Dissemination - - Implementation/Utilization
Evaluation Research

Figure 4: The Multiple KP/KU Characteristics of Evaluation Research

C. A Research Dilemma

It is important now to note that there is an inherent tension in the purposes of formative and summative Evaluation Research.

Formative Evaluation Research seeks to provide evaluative information in order that modifications and changes (if needed) may be made in the program--actions which break the rules of Research "control".

Summative Evaluation Research, on the other hand, seeks to determine the effects of a program without modifications and changes which would introduce "impurities" and reduce Research "control".

Persons familiar with Research will recognize that the above comparison of formative and summative Evaluation Research is somewhat overstated but nonetheless reflects a very real Research dilemma. It is our purpose here simply to take note of this potential tension involved in Evaluation Research, not to provide a detailed discussion of this issue, an issue that we know has been well recognized in the field in general, and by NIE and OE in particular.

D. The Same or Different Evaluation Researchers?

One related issue must also be noted here. In those programs for which there is to be both formative and summative Evaluation Research, many have questioned whether the same Researcher can properly do both. The issue here is two-fold. First, the performance of formative Evaluation Research will require some degeee of Researcher contact with program personnel at various times during the life of the program. This contact can lead the Researcher to develop interpersonal relationships with program personnel and Researcher "interest" in the program--factors which raise the question about the Researcher's capability to provide objective summative Evaluation Research. This problem involves not only Research considerations but could be and is often raised for political purposes.

Second, depending upon the nature of the formative Evaluation Research design, it may be reasonable to expect the formative Researcher to have interpersonal and communication (and perhaps design) skills which are not needed by the summative Researcher.

With these conditions in mind, consideration might be (and sometimes is) given to the use of separate formative and summative Researchers. On the other hand, such a strategy would require extra coordination and likely be more costly. More typically, in federal social service programs however, only summative evaluation research has been required, and the formative aspects have been ignored.

3. Three Purposes of Evaluation Research

To further understand the nature of Evaluation Research and the tensions associated with it, we must also be aware that Evaluation Research has three basic purposes (or uses) -- purposes which are to some degree inherently in conflict.

A. For Policy Makers and Funders

One purpose of Evaluation Research is to provide the policy makers with information about a program (or project) as a basis for decisions concerning future programs. Are the program's results (compared to program costs and objectives) of sufficient merit to warrant program continuation and/or expansion? Or should it be dropped? Can/should it be modified? If so, in what ways? Can the program be used elsewhere? As is, or in modified form? Does the evaluation of this program provide insights about other (similar) programs? As can be seen, these are post-program questions that are best answered by summative Evaluation Research. We note also, however, that in order to monitor a program, policy makers and funders may also want information provided by formative Evaluation Research.

B. For Program Administrators

A second purpose of Evaluation Research would be to provide program administrators with information upon which to base possible in-process program modifications and changes. Thus, program administrators would tend to be very interested in formative Evaluation Research -- and not so concerned with its effects on summative Evaluation Research.

Indeed, Evaluation Research (both formative and summative) are system functions -- they are a basic part of good system operating management. The program being designed and implemented should have the benefit of what can be learned as the process proceeds. It is also vital to have a measure of the impact with the needs of redesign, improvement and future efforts in mind. It is unfortunate that summative evaluation is too often associated with a threat to program personnel, so preventing its proper exploitation as an aid to the process.

C. Knowledge Production

Simply because it is Research, Evaluation Research can add to the knowledge base of the field. However, as this purpose has long-term rather than immediate impact, this potential system-building value can easily be lost simply by being overlooked by policy makers and funders (whose concerns in Evaluation Research tend to be more immediate). This value can be lost through inadequate development of the Research design, through the selection of less competent Research personnel or of "skilled" Evaluation Research personnel who have little interest in the substance of the phenomenon being evaluated, and through failure to disseminate the findings. It must now be emphasized that the *overarching* purpose of Evaluation Research is to reduce the uncertainty of decision makers -- perhaps most specifically the policy makers/funders who have ultimate control and decision power, but also the program administrators.

4. The Conflict Potential Among Significant Participants

As the above discussion has implied, there are at least three significant participants in the Evaluation Research process: the sponsoring policy makers/funders; the program administrators; the Evaluation Researchers. The program staff could be added to this list. Because of the value-laden political context of education which we discuss later, we must also add the public. Each of these participants will have differing interests and viewpoints about the Evaluation Research which may be in conflict.

We have already noted the potential for conflict between the interest of administrators in formative Evaluation Research and the interest of Evaluation Researchers and policy makers/funders in summative Evaluation Research. The Evaluation Research literature notes a further potential conflict between administrators and Evaluation Researchers. Comments that administrators tend to be concerned with organizational stability and survival issues while Evaluation Researchers introduce organizational change and growth issues are common. While both concerns are valid organizational goals, the potential for "threat" to the administrator exists -- thereby building in a potential subversion of the Research. We can add that the possibility of negative findings may also be seen as a "threat" by administrators.

5. A Real Life Context

Evaluation Research takes place in a real-life context. It is related either to a product which is disseminated into the real world or to a program designed to provide people or organizations with services.

Evaluation Research is directly related to decision making processes -- either as corrective feedback for administrators or as information which can influence policy/funding decisions. This means that Evaluation Research has an "immediate" time frame in terms of usage.

The management of what is being evaluated (i.e., a product or program) is always in the hands of (or at least influenced by) someone other than the Researcher.

As we will note in more detail later, these Knowledge Utilization characteristics of Evaluation Research are in (often sharp) contrast with the Knowledge Production characteristics of Basic and Problem-Focused Research. Knowledge Production types of Research are designed for the specific purpose of producing knowledge and may be considered important in there own right, apart from any potential real-world impact. By contrast, the concern of Evaluation Research is specifically with the real-world impact both of its findings and of the product or program being evaluated; and knowledge production per se must be considered a secondary purpose (though important, as we have noted).

We will later note that this "real-world context" has some implications for the skills and experience required of personnel.

6. The Program Focus of Evaluation Research

Evaluation Research may be performed in relation either to products or to programs. However, most often under government funding, Evaluation Research is focused on more amorphous human service "programs". Consequently, we shall concentrate the rest of our analysis on that Evaluation Research which is targeted at such social or human service programs.

A. A Specific Focus

Evaluation Research must focus on a program as the program actually is, not as might be suggested by the Researcher or the Research literature. Thus, there are significant constraints on the Evaluation Research process in terms of Evaluation Research goals, design, time frame, data availability, etc. -- constraints which Researchers tend both not to understand and not to accept. This fact can be an impediment for attracting competent Researchers.

B. Program Goals

Program goals provide the basis upon which a Research design is developed and evaluation is made. However, program goals may not be simple and clear cut; they may even be the wrong goals. When such conditions exist, the Evaluation Researcher would be confronted with two significant issues. First, designing the Evaluation Research will be difficult at best. Second, there would be the issue of the proper role of the Evaluation Researcher with regard to the possibility of suggesting changes in program goals. We shall comment further on this issue later.

C. Program Complexity

Programs are rarely simple, especially in human service fields such as education. For example, both the content and the outcomes of a program may depend as much on the competency and interests of program administrators and program staff (or on how well the program has been communicated to them) as in the nature of the program itself. This fact increases significantly the complexity and difficulty of Evaluation Research.

Similarly, programs will vary. A program may be "broad-aimed" or narrow in focus. Where a program is being carried out by different groups in different places and contexts, local variation may be permitted (or even encouraged) as for example in the Follow-Through program. Indeed local variation may exist even without "official sanction." Where local variation does exist, it will be difficult to provide an

Evaluation Research design which can validly aggregate dissimilar data. Thus, there is a danger that Evaluation Research will be based upon the "lowest common (and probably meaningless) denominator."

D. The Changing Nature of Programs

Human service programs are "change-oriented". That is, the effectiveness of human service programs is judged by the magnitude or significance of changes in human behavior or attitudes, in social settings, in community conditions, etc. The programs themselves tend to change because of feedback from participants, from Evaluation Research, from environmental forces. Thus the Evaluation Research design and methodology requirements may change. Questions of data comparability and aggregation may arise. Additionally, there will be the control issue of whether the change being measured results from the program or from other organizational or environmental factors.

E. Research Skills: A Methodological Issue

For Evaluation Research, different Researcher skills may be needed for different kinds of programs. Specifically, where a program area is reasonably well understood and the data needs, parameters, appropriate Evaluation Research designs etc. are reasonably clear, it would generally be possible for the Evaluation Research to be done by Researchers who are competent in standard Research methodology but who have minimal understanding of the program area itself.

However, where the program area is of an innovative nature, where the program area is not well understood, or where it is not clear what are the data needs, the parameters and the appropriate Evaluation Research designs, it would be imperative for the Evaluation Researcher to be quite familiar with the program area and to have skills which would enable him to create the appropriate Evaluation Research design.

7. Key Characteristics of the Evaluation Research Function

At the beginning of this functional analysis, we emphasized that Research is a basic component of Evaluation Research. Thus, we would expect to find similarities between Evaluation Research and Basic/Problem-Focused Research. However, we also noted that Evaluation Research has characteristics normally associated with the Knowledge Utilization and innovation process. Thus we would expect to find dissimilarities between Evaluation Research and Basic/Problem-Focused Research. The program focus of Evaluation Research should also lead to differences in comparison with Basic/Problem-Focused Research.

Thus, it is important to understand the characteristics of the Evaluation Research function and to understand the similarities and differences between Evaluation Research and Basic/Problem-Focused Research.

A. The Technology Base: Design and Methodologies

Evaluation Research and Basic/Problem-Focused Research are in many respects quite similar in terms of their design and methodology (the technological base). While there are differences, there would seem to be more similarities than differences. This is especially true if we include within the category of "standard" Research design and methodology the process-oriented methods of fields like anthropology and the economist's analytical approach which is increasingly used in cost/benefit studies. Thus much of the distinction between designs and methods used in Evaluation Research and in Basic/Problem-Focused Research appear to involve points of emphasis and matters of design implementation.

B. Purposes

We have already noted that Evaluation Research has three possible purposes: providing information to program policymakers/funders; providing information to program administrators; and knowledge production (i.e., adding to the knowledge base of the field). However, we have also emphasized that the overarching purpose must be the providing of information that reduces decision uncertainty for decision makers. Thus, in direct contrast to Basic/Problem-Focused Research, knowledge production per se is a secondary purpose.

C. Problem Definition

A basic issue in any Research is control over problem definition -- i.e., determining what is to be researched. In Basic Research, it is clear that the Researcher must define the Research problem. In Problem-

Focused Research, there needs to be User/funder input, but the Researcher is still predominant in translating User/funder problem statements into researchable questions.

In Evaluation Research, the decision maker rather than the Evaluation Researcher is predominant in problem definition. Indeed we find that funders often define the Evaluation Research problem before procuring the services of an Evaluation Researcher.

In this context, the issue may arise as to what is a proper role for the Evaluation Researcher when he perceives that the problem definition of the decision maker is inadequate -- i.e., too vague; too narrow; would prejudice the outcome; inappropriate for the specific program; etc. Must the Evaluation Researcher assume that he is an "employee" who merely accepts his "employer's" problem definition and statement of program objectives, carries out the task specified by his "employer", and then simply provides the "effectiveness assessment" upon demand?

Or is the Evaluation Researcher to assume the kind of "consultant/client" relationship with the decision makers that would allow the Researcher to guide his "client" in developing the problem definition and to assess the appropriateness of program rationales, objectives and strategies (in addition to measuring program effectiveness)? The answers to these questions will significantly affect the Evaluation Research process from the initial design stage to the reported findings. It appears that strong leaders in the Evaluation Research field opt for the "consultant/client" relationship, arguing that the acceptance of an "employee" type of role by Evaluation Researchers is a major reason why so much Evaluation Research has been of poor quality and has been unable to answer the questions asked.

D. Clear Targets

In contrast to Basic and Problem-Focused Research, the "target" of Evaluation Research is clear. That is, whatever the decision maker says is to be evaluated is the focus or target for Evaluation Research. The Researcher may or may not have been involved in setting the target, but there will nonetheless be a specified target.

E. Time Frame Constraints

In Evaluation Research, the time frame is specific (being defined by the decision maker) and relatively narrow (in order to provide timely information to decision makers). This is in contrast to Basic/Problem-Focused Research and is likely to be a source of tension and frustration to Researchers who have been trained and socialized in the university Research environment.

Additionally, because Evaluation Research is done in an operational, decision making context, the time lines may shift -- i.e., decision makers may make "sudden requests" for information. Where the environmental context is public and political (as in education), the probability that time lines may shift is even higher.

For Researchers trained in Basic and Problem-Focused Research, such shifting times lines are likely to be a source of incredible tension -- both because they would be unused to (and would dislike) such sudden demands and because any findings reported under such conditions would be incomplete and tentative -- and could be in error.

There is a clear implication here for an agency such as NIE. The needs of the decision makers and the resistances of Researchers both have validity. It would seem necessary, then, that some agency ensure that this tension is mediated, probably by building some form of preliminary/interim reports into the Evaluation Research design.

We must also note an inherent tension in most human service program Evaluation Research. Because the Evaluation Research is done in an operational context, the needs of decision makers will usually require the narrow time we discussed above. However, human service programs involve "people change" -- a change process that generally has a fairly long time frame, especially if community changes are also involved. That is, it may not be realistic to measure people change adequately or validly within the usually shorter time frames of Evaluation Research.

F. Tight Management

In contrast to our analyses of the other functions, Evaluation Research appears to call for a rather tight monitoring and management i.e., it is critical that the Evaluation Research process be timed to the needs of decision makers.

G. Modest Approaches

The overarching purpose of Evaluation Research is the assisting of the decision making process by reducing the level of uncertainty in decision making. Further this assistance must be provided within a relatively narrow time frame and must be specific to a particular program. Thus, in contrast especially to Basic Research (but also, to a lesser degree) to Problem-Focused Research, Evaluation Research calls for a relatively modest approach -- i.e., the objective is to provide "sufficient information" rather than "eternal truth".

II. EVALUATION RESEARCH IN EDUCATION: A SOCIAL SCIENCE CONTEXT

Introduction: A Social Science Context

The history and nature of Evaluation Research in the educational context is virtually identical with the history and nature of Evaluation Research in the overall social science context. For that reason, we will here focus our analysis on the social science context, referring to the educational context per se as relevant.

1. Historical Development of the Evaluation Research Function

Of all the R/D&I functions in the education sector, Evaluation Research has experienced the most rapid and extensive development in the last ten to twelve years.

Prior to the mid-'60's, evaluation of educational programs (when it was done at all) was carried out by educational practitioners and by some Researchers -- but rarely by people who identified themselves as Evaluation Research specialists. The approaches tended to be normative, but rarely systematic or rigorous. The predominant strategy was casual observation and analysis. Conclusions tended to be based on expert opinion, intuition, and impression rather than systematically gathered and rigorously analyzed empirical data.

This pattern changed significantly in the '60s as large-scale federally-funded social programs proliferated, and the legislation that created them tended to require the systematic gathering, analysis, and reporting of empirical data on program effectiveness. Thus, the Evaluation Research function expanded rapidly as a new specialty, even as a new industry: in less than a decade, the dollar volume of federal Evaluation Research contracts expanded at least tenfold, with a sizeable portion of the funds being used for Evaluation Research of educational programs.

2. A History of Methodological Issues

During the '60s and early '70s, there were many heated debates among Evaluation and Research theorists about appropriate methodologies for the Evaluation Research function. One group argued that experimental (or quasi-experimental) designs were more powerful than any other Research approaches for assessing the effectiveness of programs, products, or strategies -- and that it was therefore essential to use these approaches to test R&D outputs and social reform programs of all kinds. A second group argued that experimental approaches imposed unrealistic constraints on field settings -- and that at any rate it could never be possible to meet adequately the statistical, design, and treatment assumptions on which experimental approaches are premised.

Other methodological debates revolved around the need for evaluation approaches to provide feedback throughout the program development process -- not simply telling the Developer at the end of the Development process that his program did not work, but working with him throughout the process to make it better. Existing pre-post evaluation designs made it difficult for program Evaluators to provide this kind of feedback, or to understand how to evaluate a program stimulus that kept changing.

Some of these disagreements have been eased by recognition among Evaluation Researchers that there are a number of different kinds of evaluation services, each requiring somewhat different approaches and techniques. The distinction between formative and summative evaluations represents one such distinction. Initially, the same Researchers conducted both formative and summative evaluations, but over time there appears to have been some specialization of personnel and organizational units here.

Currently, the formative evaluations that are undertaken as part of the R&D program/product development process are generally carried out by Evaluators who work with Developers as part of the Development team and provide ongoing feedback designed to improve the product or program being developed. They use both quantitative data-based and qualitative judgmental approaches. Their style of functioning emphasizes flexibility -- changing their Research questions, variables, instruments, and approaches as the emerging program takes shape and perhaps goes through a number of transformations.

The debate over experimental vs. other kinds of Research designs is now centered on summative evaluations -- the evaluations undertaken to test the effectiveness of a given program or product after it has been fully developed. Summative evaluations are usually done by an evaluation agency or organizational unit independent of the program's

Developers. Summative evaluations include several types of evaluations differing somewhat in emphases because of the different information needs of the decision makers to whom they are addressed:

1. final operational field tests of an R&D output to help the R/D&I manager determine whether or not it is ready for Dissemination;
2. evaluations of the effectiveness of a given program or product in a given school or District in meeting locally defined objectives;
3. evaluations of national program initiatives, sampling program components nationwide to inform federal policymakers about the effectiveness of a given strategy (or the relative effectiveness of alternative strategies) in meeting federally defined policy goals.

There is still some disagreement about how appropriate experimental designs may be for product tests and for individual school or school District program evaluations; and many other kinds of Research designs have been proposed for these types of evaluations. Nonetheless, federal program evaluation policy (to whatever extent such a policy exists) appears to be moving toward experimental approaches -- increasing numbers of national program evaluations are being conducted using experimental designs, control groups, and some randomization of treatments. However, the difference between experimental setting in the laboratory and the field is gaining recognition. Federal Evaluators are increasingly acknowledging the need to supplement impact data with process data demonstrating that a given "treatment" was in fact implemented as specified in the program design, and that the impact evaluation is a valid test of the program and not simply a "non-event."

3. The Knowledge/Technology Base

The early phases of the maturation process of a knowledge and technology base are illustrated with particular clarity in the enormous literature produced by the Evaluation Research function over the last decade. Of all the functional R/D&I specialties, Evaluation Research appears to have experienced the most self-conscious and concerted development of its methodology during this period. The literature reflects not only the inherent difficulties of the Evaluation Research role and processes, but also the problems of weaning a new specialty away from a parent field. The early literature was filled with self-conscious analyses drawing distinctions between Evaluation Research and Basic/Problem-Focused Research and emphasizing the inappropriateness of prevailing Research methodology for the educational Evaluation Research context. Within only a few years, the distinction from Basic/Problem-Focused Research was taken for granted, and the literature documented the development of Evaluation Research as a new field with a distinctive identity.

The rapid coming of age of the Evaluation Research function could be seen in the quick succession of seminal papers produced by Evaluation Research theorists, the publication of several anthologies reprinting important articles on Evaluation Research, the frequent citation of the seminal papers of the field and the use of concepts and approaches developed in these papers. It could be seen in the emergence of a somewhat common frame of reference among Evaluation Research theorists and a common vocabulary -- including such terms as "formative" and "summative" Evaluation Research and "context," "input," "product," and "process" Evaluation Research. The maturation of the Evaluation Research function could be seen especially in the formulation of various new Evaluation Research designs and methodologies, in attempts to develop taxonomies of Evaluation Research designs, and in the publication of several handbooks synthesizing and compressing the accumulating knowledge and technology base and translating it into more readily usable reference form.

Still, the conduct of educational Evaluation Research and the quality of Evaluation Research outputs have been the focus of considerable criticism. The field still lacks an adequate theoretical base. Evaluation Research instrumentation is in a most rudimentary state of development. Basic conceptual and methodological dilemmas remain unresolved. Though substantial progress has been made in recent years, the knowledge and technology base of the Evaluation Research function must still be considered relatively immature and underdeveloped.

4. The Study of Social Change: A Serious Dilemma

The discussion of methodological issues and of the knowledge/technology base in Evaluation Research provides a context for considering a serious dilemma.

The study of social change is one of the least developed subject areas within the social sciences. Our understanding and measures of social change tend to be far less incisive and sensitive than they need to be, given the fact that Evaluation Research of social change can determine the fate of human service programs.

Thus, the Evaluation Researcher is faced with a serious dilemma. He must assess change in a changing context (perhaps changing in part because of his presence) -- but he must use methods which may be inadequately sensitive to the critical changes taking place. Indeed, he may not even be able to determine at the time which changes are fundamental and critical and which are instead only fleeting and tangential -- i.e., he may be measuring and studying the wrong variables.

While to some extent this problem must be encountered by other Researchers in field settings, the problem is rarely as pervasive and central for other Researchers, who tend to be less critically concerned with detecting change and who may have less need to assess change in relation to a set of variables so amorphous and changeable as the defining characteristics of a given human service "program."

5. The Personnel/Institutional Base

The discussion thus far has indicated that there exists today the beginnings of a significant Evaluation Research community with its own separate identity. This fact is illustrated by the existence of journals, books, articles and even university training programs which focus specifically on Evaluation Research.

However, the field is not yet mature and has certain characteristics which must be considered here.

First, there are as yet relatively few persons well trained specifically in Evaluation Research, though many more than was the case in the mid '60s when the sudden upsurge of federal funding for Evaluation Research (coupled with much lower levels of funding for Basic and

Problem-Focused Research) created a vacuum that was rather naturally filled by Basic and Problem-Focused Researchers -- Researchers who were trained primarily in psychology and sociology. While these Researchers do fill a gap in Evaluation Research, it must be noted that they would tend to be quite frustrated by the relatively formidable constraints that exist within the Evaluation Research function (e.g.: time frame constraints; the lack of control over problem definition). Such Researchers would also have the tendency to redefine Evaluation Research problems and questions into Basic/Problem-Focused Research types of problems and questions.

Secondly, the bulk of federal Evaluation Research funding has gone to private sector organizations and relatively little has gone to the university setting. In the Evaluation Research industry as a whole, statistics for HEW-funded Evaluation Research indicate that in 1970 45% of these federal funds went to for-profit firms; 29% went to not-for-profit organizations; 21% went to the universities; 4% went to State and federal agencies; and 17% went to individual consultants (Abert, 1971).

Rossi (1976) has suggested that naiveté in Evaluation Research procurements has "turned off" the best Researchers. That is, Rossi suggests that while it is easy to do Evaluation Research poorly and naively, good Researchers have recognized (and thus shunned) Evaluation Research procurements which pose questions that cannot be answered or cannot be answered within existing constraints. In a similar vein, evaluation of Evaluation Research by the Russell Sage Foundation indicates that the high quality Evaluation Research tends more often to be done by the academic community than by the relatively new private sector Evaluation Research firms that make up the bulk of the Evaluation Research "industry."

The existence of an Evaluation Research community (even though not yet mature) and the evidence that quality Evaluation Research tends to come from the academic community would seem to imply the need to reconsider Evaluation Research funding policies in terms of selective support to facilitate the maturation of a core community of competent Evaluation Researchers.

6. A Value-Laden Political Context

Evaluations are often described as management tools designed to provide a "rational basis for decision making" -- but decision makers in the public sector function in a largely political sphere. This fact raises important issues for the Evaluator on both theoretical and practical levels.

On the theoretical level, we must ask if political considerations are "irrational," or are they based on "a different model of rationality" from the one generally used by social scientists?

On the practical level, consideration must be given to the politics of decision making. Generally speaking, programs are created by political coalitions of diverse interests -- interests which support programs for diverse reasons. These coalitions tend to view negative Evaluation Research findings unfavorably -- and generally have enough influence to modify or bury negative findings and keep their programs going regardless of what Evaluators report. Conversely (yet similarly), programs may be opposed by other political interest groups -- interest groups who will use findings of Evaluation Research to achieve their ends. Thus, Evaluation Research findings may be used, misused, modified, reinterpreted, buried, etc. -- in other words, used as a "political football." Given the political context and the methodological issues we have noted above, it is not surprising that controversies over negative findings often focus on methodological rather than substantive issues raised by the findings themselves.

Additionally, we must note that the educational context is value-laden, and value choices enter virtually every one of the key decisions made by the Evaluator. The outcome of Evaluation Research may be predetermined by the choice of Research questions and objectives, the criteria used in judging effectiveness, and the measurement instruments administered. From the human perspective, the question must be asked: Is the Evaluator value-free when doing Evaluation Research? From the organizational/political context perspective, the question must be asked: To what extent is/should these key value decision choices of the Evaluator be influenced by the organizational information needs of the decision maker on the one hand

and the political context/dynamics on the other hand?

In contrast, Basic and Problem-Focused Research are not so immersed in and vulnerable to a political value-laden context. They do not so directly affect the public or decision makers and they tend to be remote from the political arena.

The political value-laden context raises some important issues for the Evaluation Research function. Most importantly, it becomes critical that potential political issues be dealt with at the beginning of the design stage. This would imply a fair degree of interaction between the decision makers on the one hand and the Evaluation Researchers. If political issues are not dealt with at the beginning, they will most likely have to be dealt with later in a highly dysfunctional "attack/defend" context, and significant findings are likely to be muted, suppressed or challenged on "methodological" grounds.

A second important issue is that unless they are dealt with, political issues are likely to be a strong source of frustration and tension for Evaluation Researchers -- a fact that can be highly dysfunctional to the long term health of the Evaluation Research function (and thus to the total educational R/D&I system).

A third potential issue is that Evaluation Research may be used by program administrators (and perhaps even funders/policy makers) as a "court of last resort," a "panacea" to bail out and save a failing program.

7. Control Over Outcome

A very strong issue for Evaluation Research that is generally not found in Basic/Problem-Focused Research is the issue of who controls or "owns" the outcome (the findings). This is both a theoretical/definitional issue, a practical issue and a political issue.

As a definitional/theoretical issue, we note that because Evaluation Research is Research, the implication would be that the public and the educational R/D&I system (through the Evaluation Researcher) should have access to the findings of Evaluation Research. Additionally for government-funded Evaluation Research, there would seem to be a reasonable presumption that the findings are public data. However, we must also note that since the purpose of Evaluation Research is to assist decision makers, it is they who initiate, procure and receive the findings of Evaluation Research, we might assume that the decision maker has control over Evaluation Research Outcomes.

However, there are practical matters to be considered. As the one who initiates, procures, funds, receives and uses the Evaluation Research findings, it would seem reasonable to assume that decision makers have and will exercise control over outcome, especially given the political, value-laden context. Thus, for practical purposes we must assume that the decision maker controls the findings and that the Evaluation Researcher has, in fact, no control over how the decision maker will utilize the findings -- a fact that can be a source of frustration and tension to the Evaluation Researcher.

One additional aspect of this issue warrants consideration. The program administrator may have valid reasons for not wanting preliminary findings to be made public prior to the final summative Evaluation Research report. Specifically, the program administrator may feel that in such a political, value-laden context, the release of preliminary findings (which may be in error) could lead to unnecessary but seriously dysfunctional interventions in the life of the program before the program has had a chance to "mature." On the other hand, policy makers and funders may validly request preliminary findings in order to monitor the program.

The resolution of this issue would probably be to have only limited circulation of the preliminary findings, with the understanding that these would be available for use in the final evaluation report.

8. The Educational Context

While the educational context for Evaluation Research is basically the general social science context, there are some sectoral-specific characteristics that we should note.

A. Design Variations

Because of the size and variety within the educational sector (and because we do not yet have a fully mature theoretical and methodological base for social science Evaluation Research), consideration must often be given (for the larger-scale programs) to planned or unplanned variations in the programs which are being evaluated and thus potentially in Evaluation Research designs. An example of planned variation is the Follow Through program, which permitted local selection of model variations.

Variation in programs and Evaluation Research design may be planned -- or they may be unplanned. Given that the educational system is a large, autonomous, decentralized and highly varied system, there is really no way to ensure fully that actual implementation will be the same as the designed (planned) implementation.

Whether planned or unplanned, variations in program implementation and in Evaluation Research design create significant problems for comparative analysis across settings and for aggregation of a data base.

B. Multiple Levels of Government

Probably more than the other sectors, educational R/D&I involves all levels of government. Inherent in this fact is a problematic tension for Evaluation Research. On the one hand, decision makers at the various levels will have different information needs (including both practical and political information needs). To meet these different information needs would likely require collection of more and different data than would be needed for decision makers at a single level of government. To meet these different information needs would quite possibly require a somewhat different (or at least a more extensive) Evaluation Research design -- perhaps several separate designs. As might be illustrated in the case of Title I, there is the danger of reducing Evaluation to the trivial level.

On the other hand, the need of those who fund and make policy decisions from Evaluation Research need cumulative, aggregatable data which is comparative across settings. There is some trend for governmental agencies to require certain data to be uniform (e.g.: New York; Office of Education).

The issue for Evaluation Research designing is thus the extent to which varying information needs can be met while still providing cumulative, aggregatable data which is comparative across settings.

C. Awareness of Formative/Summative Evaluation Research Issues

We have already noted the issues related to formative and summative Evaluation Research. There was a concern in education that the formative Evaluation Research needs were not being met. The response to this concern has been for Evaluation Researchers to work with Development teams in educational labs and for some evaluation consultants to work with school districts in order to provide feedback to them. Thus, the education field has developed a certain degree of awareness of formative/summative issues.

III. IMPLICATIONS FOR NIE

1. Orchestration as the Major NIE Role

As we have found true for the other functions we have analyzed in this study, the major role of NIE in relation to Evaluation Research is that of system orchestration. In Evaluation Research, the orchestration will be both complex and vital. The complexity is illustrated by the aspects of orchestration which are described below. However, probably the major underlying consideration is that given the highly political and value-laden nature of the education sector, Evaluation Research must be done well -- and it probably will not be done well without NIE leadership in orchestrating the various complexities involved. In this light, we now focus our discussion on those aspects of the Evaluation Research function which require orchestration. We now turn to a consideration of these aspects.

2. Formative and Summative Evaluation Research

The need for orchestration of formative and summative Evaluation Research is two-fold:

1. There is a tension between the need for "pure" data for summative Evaluation Research and the fact that formative Evaluation Research does introduce change into programs. This tension will need to be mediated in the designing of the Evaluation Research.
2. NIE will have to make decisions concerning the issue of whether a single Researcher can validly do both formative and summative Evaluation Research, or whether separate Evaluation Research organizations are required. If the latter course is chosen, then NIE will have to orchestrate the Researchers in terms both of the tension between the two modes of Evaluation Research and the need to ensure that the data obtained from both Evaluation Research organizations is compatible and cumulative.

3. Differing Information Needs

Here, NIE will need to determine for which levels of governmental agencies information needs are to be met. To the extent this includes several levels, NIE will need to ensure that the Evaluation Research findings are cumulative, aggregatable, and comparable across settings -- and are not reduced to the level of triviality.

4. The Political Context

We have noted that Evaluation Research is done in a very political, value-laden context, with the result that Evaluation Research findings may be controversial and may be distorted, suppressed, rejected, etc. Thus it becomes vital that political issues be dealt with in the initial design stage in order to develop and specify the way in which negative Evaluation Research findings would be dealt with.

This would seem to imply that there must be communication between Evaluation Researchers, program administrators and policy makers/funders in the design process. This would on the one hand tend to make the Research Evaluators more sensitive to political realities and constraints and would on the other hand tend to make decision makers more aware of the danger that Evaluation Research findings might be pre-determined by the Evaluation Research design. Such forums of communication would force consideration of Evaluation Research design objectives and designs and would make the bases of decisions more explicit.

5. Problem Definition

Final decisions about problem definition in Evaluation Research are in the hands of those who procure and fund the Evaluation Research -- not in the hands of the Evaluation Researcher. However, the Researcher may be in a position to make valuable (and in some instances, essential) contributions to the definition of a problem. Thus the need is to ensure mediation of a variety of perspectives about the problem definition for a specific Evaluation Research project.

6. Are Evaluation Research Findings "Public" Data?

There is an issue as the whether or not (and to what extent) findings are to be considered "public" data. This is a political/value decision, and it is not our intent here to debate whether or not government-funded Evaluation Research findings are to be considered "public" data. We do want to note that failure to resolve this issue at the beginning of the Evaluation Research process is likely to result in a heightened degree of political controversy after the Evaluation Research is completed.

One further aspect of this issue warrants further consideration. While program administrators and policy makers/funders need to have preliminary, interim reports, widespread dissemination of such preliminary findings could result in dysfunctional interventions in the life of a program. This potential might be resolved by limiting the initial distribution of preliminary findings, but ensuring that they may be utilized in final reports which could have wider distribution and availability.

7. Interim Reporting

We have noted both the need of decision makers for preliminary interim reports and the potential frustration of Researchers about providing highly tentative findings -- especially when the demand comes unexpectedly. Thus, the orchestration role of NIE is to mandate that decision makers have information when they need it; ensure that information is not demanded which it is not feasible to provide; ensure that demands are not made unexpectedly on Researchers; and monitor to ensure that the periodically needed information is provided the decision maker.

Additionally, it would seem important that Researchers understand the needs of decision makers for preliminary data on the one hand and that decision makers be aware on the other hand of problems caused when unexpected demands are made or when the information requested cannot feasibly be provided.

Thus, it would seem that a process for providing preliminary interim reports should be built into the initial Evaluation Research design.

8. Staging

In the Evaluation Research function, there are several rather clearly defined stages which have different basic requirements.

A. The Design Stage

The design stage of Evaluation Research is critical. It is necessary at this stage to identify potential political issues and determine how these will be dealt with when the Evaluation Research is completed. It is necessary to insure that problem definitions and Evaluation Research objectives are clear, relevant and within the limits of Research feasibility -- and that a variety of perspectives are considered in determining the problem definition and the Evaluation Research objectives. It is necessary at the design stage to determine whose information needs will be met and to determine what interim reporting is to be provided.

Because of the critical nature of the design stage, it is vital that the best Evaluation Research talent be obtained -- a fact which would suggest that NIE must exercise a relatively high degree of control over the selection process.

B. The Data Collection Stage

Once the problem definition and the Evaluation Research objectives are clear, there generally would be a whole range of personnel and organizations competent to perform data collection. The "best minds" are not necessarily needed. Thus, a competitive bidding mode would be relevant.

There is an exception. In the instance where there is a high level of uncertainty about how to define the problem, what methods are really valid, etc., the Evaluation Researcher must have a high level of understanding of the area to be researched and must be creative and innovative in designing the Evaluation Research. In this instance, particular skills are required; thus, NIE control over the selection process would be a more relevant strategy than open bidding.

C. The Data Analysis and Reanalysis Stages

The findings of Evaluation Research are critical both in the sense that important policy/funding decisions will be based on the findings and in the sense that education is a politically sensitive, value-laden area. It follows, then, that it is important to obtain the strong analytic personnel of the field for data analysis and reanalysis. In this context, NIE control over the selection process would be the relevant strategy.

For the same reasons, data reanalysis is often provided (e.g.: the Coleman Report; the Racial Isolation Report). Thus, a strategy might be considered whereby more than one Evaluation Research organization provides simultaneous data analysis. In effect, this would be doing data reanalysis during the basic data analysis stage.

D. Formative and Summative Evaluation Research

Formative and summative Evaluation Research require orchestration at two points. First, the tension between formative and summative Evaluation Research must be mediated. Second, decisions must be made as to whether formative and summative Evaluation Research will be done by the same or different Evaluation Researchers. If done by different Researchers, their efforts must be coordinated to insure that the data of both will be cumulative, aggregatable and comparable.

9. Portfolio Effects on System Capability Building

Because there are various Evaluation Research organizations already in the field, system building per se would not appear to be a primary concern here. However, we have noted that while the best Evaluation Research talent and the best Evaluation Research work tends to be found in the academic setting, federal funding is far more supportive of private sector entrepreneurial organizations. This would imply a system capability mode of funding which selectively focuses on the academic sector, and possibly even focuses upon a specific set of universities and university-related organizations.

10. Monitoring and Tight Management

The emphasis in Evaluation Research is that it must be done well. Thus the process must be closely monitored. A "tight management" mode would seem to be relevant in order to insure that basic requirements are met -- yet care must be taken to insure that the management is not unnecessarily and unduly restrictive.

11. NIE Internal Considerations

A. Relation of NIE to the Field

The orchestration requirements of the Evaluation Research function suggest the need for NIE to have ongoing, close working relationships with the field, but do not (in contrast to Basic and Problem-Focused Research) appear to require that NIE actually be involved in Evaluation Research. Thus, we have suggested, the need appears to be for NIE to have top level personnel who have a combination of substantive/methodological skills and political savvy.

B. NIE Personnel

As we have noted, NIE must have some top level personnel who have substantive and methodological Evaluation Research skills, on the one hand, and political savvy and insight, on the other. Such persons would be able to understand the critical implications of: different ways of defining problems; different Research methodologies and their relevance to types of programs and program situations; and the needs of the different participants -- i.e., the policymakers/funders, the program administrators, and the Evaluation Researchers. Additionally, it is imperative that NIE personnel have skills relevant to the process of orchestration.

REFERENCES

Abert, 1971. Statistics adapted from James G. Abert, "Cost and Cost-Effectiveness." Paper delivered at International Federation of Operational Research Societies International Cost-Effectiveness Conference (Washington, D.C., April 12-15, 1971, unpublished) as cited in Albert D. Biderman and Laure M. Sharp, The Competitive Evaluation Research Industry (Washington, D.C.: Bureau of Social Science Research, May, 1972), p.23.

Bernstein, Ilene N. and Howard E. Freeman, Academic and Entreprenurial Research: The Consequences of Diversity in Federal Evaluation Studies (New York: Russell Sage Foundation, 1975).

Rossi, Peter H., "Assessing Organizational Capacity for Educational R&D in an Academic Institution," Educational Research. (5,4, April 1976), pp.3-10. This paper was originally prepared at the request of Ward Mason of the National Institute of Education for internal use of the R&D System Support Division.

SUMMARY ANALYSIS ACROSS FUNCTIONS AND CONTEXT: IMPLICATIONS FOR THE ROLE OF NIE

INTRODUCTION

I. A COMPARATIVE ANALYSIS ACROSS FUNCTIONS: DEVELOPING A SYSTEM CONTEXT OVERVIEW

1. The Mission of NIE
    - A. The NIE Mission: Narrow or Broad
        - 1. A Narrowly Defined Mission: A Passive Channel for Funding
        - 2. A Broadly Defined Mission: System Oriented Responsibilities
    - B. Some Implications
2. The State of the R/D&I System
    - A. Mature and Immature Systems
    - B. Some Illustrative Implications
        - 1. System Building
        - 2. The Dissemination Function
        - 3. Agency Directiveness Toward the Field
    - C. The State of the Educational R/D&I System
        - 1. Varied and Large
        - 2. Immature
        - 3. The Nature of Education

II. A COMPARATIVE ANALYSIS ACROSS FUNCTIONS: THREE MAJOR COMMON THEMES

1. A Requirement for NIE Leadership
    - A. The Need for NIE Leadership
    - B. The Form of NIE Leadership
    - C. The Agency vs. Field Issue
    - D. Functional Area Differences
2. System Building
    - A. The Need and Implications
    - B. The Field vs. Agency Issue
    - C. Functional Area Differences
3. Orchestration as the Major NIE Role
    - A. The Need for System Orchestration
    - B. The Agency vs. Field Issue
    - C. Functional Area Differences

III. A COMPARATIVE ANALYSIS ACROSS FUNCTIONS: SOME OTHER COMMON THEMES

1. Varied But Close Agency/Field Relationship
2. Multi-Purpose and Portfolio Emphases
3. Staging
4. Process vs. Product Management Approach
5. Facilitating, Buying or Renting
6. Mixed Strategies

IV. A COMPARATIVE ANALYSIS ACROSS FUNCTIONS: SIGNIFICANT DIFFERENCES

1. Time Frame
2. Excellence
3. Key Criteria for Project Selection

V. A COMPARATIVE ANALYSIS ACROSS FUNCTIONS: NON-PROCUREMENT STRATEGIES AND NIE PERSONNEL

1. Non-Procurement Strategies
2. NIE Personnel
3. Structures

VI. CONCLUDING REMARKS: COST CONSIDERATIONS IN RELATION TO POTENTIAL LONG-TERM INVESTMENT PAYOFF

SUMMARY ANALYSIS ACROSS FUNCTIONS AND CONTEXT: IMPLICATIONS FOR THE ROLE OF NIE

INTRODUCTION

For a federal agency such as NIE, the value of an analysis of R/D&I systems is determined by the implications that can be derived for policy and strategy decisions -- i.e., the identification and evaluation of policy/strategy options and issues. At this point, however, it becomes imperative to place some practical limitations upon the nature and extent of R/D&I system analyses.

On the one hand, time and cost considerations make it impossible to undertake a "theoretically complete" analysis -- the considerations involved in a total contextual analysis of all functions and functional issues would be horrendously massive and complex; the needs of the educational R/D&I system are more than NIE could possible respond to; there is a vast array of possible options available which are potentially relevant to NIE purposes. Thus, the analysis of the system must be narrowed down to a feasible scale.

On the other hand, the analysis must remain sufficiently broad and rich so as to provide insight and guidelines for policy and strategy decisions.

Agency personnel need not be overwhelmed by the number and diversity of unfamiliar courses of action suggested. Rather, NIE should accept the fact that it cannot do all the kinds of things we have suggested, at least in the short run. The Agency will be selective (as it should be) and determine its priorities.

To provide a framework within which the Agency can identify and evaluate relevant policy and strategy issues and options, it is essential for the Agency to have a basic understanding of:

1. the R/D&I system as a system -- a system to be understood in terms of a total, interactive context which will include the system's environment, the operative conditions existing within the system, and the various system functions;
2. generic and sector-specific system characteristics;

3. similarities and dissimilarities between the various system functions;
4. the implications of the above for determining appropriate Agency policies and strategies.

The analyses of the four functions will have begun to provide such a framework for the Agency. We now turn to a cross-function comparative analysis (in summary form) to add to the Agency's analytical/decisional framework.

I. A COMPARATIVE ANALYSIS ACROSS FUNCTIONS: DEVELOPING A SYSTEM CONTEXT OVERVIEW

A cross-functional analysis suggests that the overall requirements for NIE policies and strategies arise out of three bases:

1. a sense of NIE's mission as one involving system building and various subtle forms of system management;
2. an understanding of the general immaturity of the educational R/D&I System at the present time, what this suggests about the appropriate roles to be played by a lead agency with responsibility for building an "effective R&D system" and what changes in Agency behavior might be called for over time as the system matures and the capabilities of the field are better developed; and
3. the political, value-laden, social science based nature of education.

We shall consider each of these points in turn.

1. The Mission of NIE

Before any consideration can be given to specific policies and strategies, we must address the more fundamental issue of how NIE sees its mission. This issue may also be defined from another perspective. By definition, NIE is a funding agency of the federal government. Thus, the key question becomes: What "mission" perspective will determine how NIE allocates the (limited) federal funds under its control? The answer NIE gives to this question will largely determine:

1. what NIE will and will not do;
2. what effects NIE will and will not have on the total educational system in general and on the educational R/D&I system in particular.

A. The NIE Mission: Narrow or Broad

In the most general sense, NIE could define its mission from either of two perspectives:

1. A Narrowly Defined Mission: A Passive Channel for Funding

NIE could define its mission narrowly as being simply a passive channel of funds from the federal government to the education sector. Such a narrow definition of mission might seem appealing at first glance, but it provides no real basis for making choices of allocation of limited resources among multitudinous projects, educational organizations, etc. At best, this perspective would permit some kind of simplified "percentage distribution" formula (e.g.: 10% to Research; 10% to Development; etc., or 25% to SEA; etc.) At worst it ignores the full implication of the need to have the appropriate quality institutions and personnel that should be utilizing these funds.

2. A Broadly Defined Mission: System Oriented Responsibilities

On the other hand, NIE could see its mission more broadly; i.e., accepting the responsibility to also use federal funds to facilitate and develop the educational R/D&I system. This system-oriented mission would include concern for system building, system maintenance, system monitoring, etc. as well as the channelling of funds for direct product procurement purposes -- in a word, a responsibility for determining and shaping the nature and direction of the system. From this missional perspective, NIE would have the key role of using its funding capabilities to orchestrate the various parts of the system.

As the discussion in the previous sections of this report indicate, CISST is assuming that NIE has and accepts the broader, system-oriented definition of its mission. Our assumptions are derived from our knowledge and study of R/D&I systems in general, our discussions and experience with NIE personnel, and our analysis of the R/D&I context of the education sector in particular.

B. Some Implications

If NIE does not accept this system-oriented mission, then the Institute is likely to disagree with our systems analyses. More importantly, however, the educational R/D&I system is likely to remain immature, underdeveloped, weak and ineffective -- with likely long-term negative effects for the Institute and the whole educational R/D&I system. Given the nature of R/D&I systems in general, and weaknesses of immature R/D&I systems (such as education) in particular, some system-wide agency must perform a system-oriented role. In the education sector, NIE as the lead agency for Research and Development appears to be the most likely candidate and probably the only agency with any inclination toward performing this role.

If NIE does accept a system-oriented mission, then this must be made clear -- to all Agency personnel, to members of the R/D&I and operating system, to Congress, and to the public as well.

2. The State of the R/D&I System

If NIE accepts a system-oriented mission, then this mission must be accomplished within the context and set of needs, opportunities and constraints dictated by the state of development of the educational R/D&I system. Effective strategies tend to be context-bound, appropriate to the reality of a given set of contextual conditions in a given time and place. Thus, policies and strategies cannot be based on abstrations: e.g.: that field-initiated R/D&I activity is always "good"; or that Agency directiveness is either always "necessary" or always "bad".

A. Mature and Immature Systems

Broadly speaking, R/D&I systems may be described as being relatively mature or relatively immature.

For example, in a mature system, one would tend to find: specialization among functions; a basic, solid core of trained and experienced personnel within each function; communication networks which facilitate information flow within and between functions (e.g.: journals, "invisible colleges"); Users who can differentiate between "good" and "bad" products; Users who have (or can obtain) the technical capabilities necessary for successful Implementation/Utilization of innovations; etc., etc.

In an immature system, one would tend to find the above to be lacking -- i.e., there would be numerous critical "gaps" in the system.

B. Some Illustrative Implications

To illustrate the nature and implications of the differences between mature and immature systems, let us look at the following examples:

1. System Building

In an immature system, the weaknesses and gaps of the system indicate that system-building needs to be a major policy/strategy emphasis. In a mature system, the major aspects of the system already exist and are generally functioning well. Thus, in terms of capacity, system facilitation rather than system building becomes the relevant policy/strategy emphasis.

2. The Dissemination Function

As another example, in an immature system, there is a need to "fill gaps" and to develop Dissemination mechanisms. In a mature system, one would work with and through existing Dissemination mechanisms. Further, we should note that some of the roles and mechanisms which would need to be created to serve the needs of an immature system would not be needed (and could even become dysfunctional) as the system matures. Thus, it may be necessary to build in change (and even termination) for those Dissemination mechanisms which are developed within and for the immature system.

3. Agency Directiveness Toward the Field

An immature system will tend to lack self-controlling and self-orchestrating (organizing) capabilities. Thus, it is likely that the Agency will have to provide a significant amount of direction (though how this is done will vary across the functions). In a mature system, less Agency directiveness will tend to be needed because self-controlling and self-orchestrating mechanisms will exist within the field (e.g.: through the "invisibile colleges"; through quality control mechanisms built into the Development process).

C. The State of the Educational R/D&I System

The functional analyses of this study reveal two basic characteristics of the educational R/D&I system.

1. Varied and Large

The User population in education is quite varied. The User may be seen as teachers, administrators, local and State agencies, and (ultimately) students. School Districts will vary by size, level of funding, professionalism of teachers, needs (e.g.: urban /rural), etc.. Within a single school, there may be varied needs (e.g.: vocational education; bi-lingual needs; etc.). The publics of the educational environment are also many and varied (e.g.: parents; political groups; etc.). Further, the potential Users are numerous -- thousands in terms of school districts alone.

2. Immature

The educational R/D&I system is clearly immature. There are significant gaps in functional specialization. Both the institutional and personnel base tend to be weak. Many of the existing institutions are weak or are inappropriately organized for carrying out certain functions. Some may have been hurt by previous federal funding policies that shifted their nature from organizations carrying out the full range of R/D&I functions to more narrowly specialized Development organizations. The field has attracted an inadequate supply of first rate talent and much of the work that is produced is poor in quality. The field's knowledge/ technology base is weak. Communication mechanisms for information flow and quality control are underdeveloped. There is little consensus on standards for judging the quality of outputs. User system capabilities for selecting, adapting, and implementing externally developed innovations are weak. In all, then, the educational R/D&I system is immature and requires Agency behaviors appropriate to an R/D&I system in an immature state of development.

3. The Nature of Education

Education as a sector is highly vulnerable to social and political influence and is often subjected to considerable pressure from the public and from Congress as well as from the varied participants within the R&D and operating systems. Schools are public service institutions supported by public funds and regulated by public agencies. Education by its nature tends to have diffuse goals that are subject to value judgments, misinterpretations and controversy -- goals that are harder to specify, less measurable, and harder to use as standards against which to judge system performance. Contributing to this vulnerability is the weakness and uncertainty of the field's knowledge/technology base and the public's view of itself as having much knowledge about education (in contrast to such other fields as health).

Given the dependence of both the operating system and the R/D&I system on public funding, and the generally negative climate that has surrounded R/D&I funding in recent years, substantial clarity about the Agency's long-term system building role, and its implications for Agency procurements and other actions, would seem to be essential.

In sum, we have suggested that Agency strategies must be developed with a view toward system-oriented responsibilities conceived in terms of the state of maturity of the educational R/D&I system and the vulnerable nature of the educational sector in general.

In the following sections we will be summarizing key issues and implications across the functions we have analyzed. The issues we have already posed will, inevitably, reappear - each in their appropriate functional context, giving the appearance of some redundancy. This is inevitable and proper given our policy making forms --a focus that often finds redundancy preferable to elegance and parsimony.

II. A COMPARATIVE ANALYSIS ACROSS FUNCTIONS: THREE MAJOR COMMON THEMES

With the above overview perspective in mind, we now turn to a comparative analysis of the four key R/D&I functions which we have previously analyzed separately.

It is important to note that a number of common themes appear across all four functions. At the same time we must also note that the operationalization of each of these themes tends to be different within each function. It is important for NIE personnel to be sensitive to these differences. The differences are substantial in terms of some of these, less significant in relation to others. We now examine each of these common themes in relation to each of the four functions.

Three of the common themes are of sufficient significance to warrant separate attention at the beginning of our cross-functional analysis:

1. A requirement for NIE leadership;
2. System building;
3. Orchestration as the major NIE role.

1. A Requirement for NIE Leadership

A. The Need for NIE Leadership

Given the size, variability and immaturity of the R/D&I system, there is clearly a need for a nationwide agency to exercise a system leadership role and to provide direction for the system. NIE is the only agency likely to undertake such a role in the education sector.

B. The Form of NIE Leadership

The need for NIE leadership must thus be taken as a "given". For policy and strategy purposes, the issue now becomes the form of NIE leadership. We have noted for each function that the nature of the function and the state of the educational R/D&I system indicate that a process mode of management will likely be more effective than a management mode based on administration of detailed plans. Even here, however, the form of process management will differ somewhat across functions (as we shall discuss later).

C. The Agency vs. Field Issue

This finding has a specific implication for the Agency/Field relationship issue. That is, the relevant issue is not so much one of Field-Initiation vs. Agency-Directiveness as it is one of the way in which NIE will provide the leadership which only it can provide.

D. Functional Areas Differences

Basic Research

Given the high level of uncertainty involved in Basic

Research, the NIE leadership role will be one of selecting Research areas and identifying quality activities in the field to support through NIE funding.

Problem-Focused Research

In Problem-Focused Research the key decisions are likely to be those involving selection of strong institutions for long-term support in an institution building (or re-building) mode.

Development

In relation to large-scale Development organizations, the needed NIE leadership role is likely to be on the early stages of Need Identification, i.e., providing some direction to these organizations about the kinds of Development outputs needed. In relation to practice-based and practice-related Development, NIE leadership will be required to buy and/or rent needed capabilities to strengthen this Development mode.

Dissemination

As we have noted, Dissemination is a system-creating function and is thus vital for R/D&I system building efforts. Since the Dissemination function is relatively weak in education, NIE will have to provide leadership in the designing and building of the educational Dissemination system.

Evaluation Research

Two aspects of the nature of Evaluation Research in education require that NIE closely monitor and orchestrate the Evaluation Research function.

1. NIE must provide leadership to ensure that potential political issues are resolved (as far as possible) at the design stage of Evaluation Research. Political issues which are not dealt with until after the Evaluation Research is completed may very likely to destroy any benefits that might

have been obtained from the evaluation.

2. NIE must provide leadership to mediate the varying information needs of different system participants on the one hand (i.e., program managers, funders, and evaluators), and to ensure on the other hand that the Evaluation Research is not reduced to a meaningless "lowest common denominator".

2. System Building

A. The Need and Implications

Simply because of the relatively immature state of the educational R/D&I system, we have noted in each function that system building is a key long-term need. This implies that system building should be one of the main criteria for NIE policy/strategy decisions (and thus, also for project selection, etc.). This further implies giving consideration to multi-purpose and portfolio effects in project and contractor selections.

The functional analyses also noted that organizations and roles created to meet the needs of an immature system may be unnecessary and even dysfunctional in a mature system. Since organizations tend toward self-perpetuation and self-expansion, system-building must include the capacity to respond to change -- even to termination of some aspects of the system.

Finally, the functional analyses noted that in an immature system, the kind of system building that is *needed* in the long term may not be what system members *want* at the present point in time.

B. The Field vs. Agency Issue

The above analyses further illuminate the Field/Agency issue. Specifically in relation to system building, NIE will have to assume a major responsibility.

C. Functional Area Differences

Research

We have stressed that the system-building process in Research is a slow process. Further, the rate at which Research systems *can* be built is limited by the extent of already existing centers of excellence. Thus, if more funding is provided than the *existing* personnel/institutional base of excellence can productively absorb, the result would tend to be mediocre Research and the mediocre training of personnel.

The field has a strong role to play here in working with the Agency to guide decisions on which areas should be supported, which institutions, etc. At this point in time, the system-building purposes of any Research procurement are likely to have long-term implications as significant as (and often more than) the specific substantive output of the Research project itself. The Agency needs to be clear and explicit about this, and develop some understanding for this position within the Research community, the Congress, and perhaps the public more broadly.

With regard to Problem-Focused Research, a re-building mode may be required to restore the Problem-Focused Research emphasis to many of the larger scale organizations that have been turned into Development organizations through the shifting priorities of federal funding in the late '60s. To increase the viability of university settings as centers for large-scale, high quality long-term Problem-Focused Research, one option may be to create joint university-non-university contexts for such Researchers.

Development

NIE's system building responsibilities in relation to large, specialized Development organizations would seem to be to ensure the development of mechanisms that link these organizations to Users. In relation to practice-based/practice-related Development work, NIE will have to make decisions about buying and/or renting the needed capabilities to identify, package, produce and disseminate exemplary programs and practices.

Dissemination

Since Dissemination (as a linking function) is system-creating, system-building takes on special importance within the Dissemination function. Given the complexities of the Dissemination function and the need to permit the development of a redundant full-scale kind of system that provides Users with alternative channels of access to the resource base of the field, system design is the key to NIE's role. Given the immaturity of the overall R/D&I system, intermediary organizations will be needed between R&D Producers/Suppliers and Users -- but such organizations must be designed in a manner that will mandate their "withering away" as the system matures and makes them not only less necessary but also somewhat dysfunctional.

It is vital to note that the rate at which the system can be established and expanded must be congruent with the much slower rate of User absorption of new information and new information sources. Otherwise, the system will create unrealistically high expectations of rapid and widescale impact, thereby leading to disappointments that will have long-term negative effects on the system.

All of these requirements suggest the considerable complexity involved in this kind of system building and the need for great Agency skill in carrying out this task.

Evaluation Research

We have noted that there exists the beginnings of an extensive Evaluation Research community with, however, a good deal of variability among the institutional and personnel bases. We have further noted that different stages of Evaluation Research require different skills that are likely to be found best developed in different organizations.

Thus, the system building role that is needed to develop the Evaluation Research function is not one of system creation as much as identifying, developing and orchestrating the existing Evaluation Research community. Critical will be the need to select those relevant and qualified institutions upon which to build and whose efforts should be facilitated. NIE's own quality control and selection skills will be critical here.

We must also note that the political, value-laden nature of educational Evaluation Research underscores the importance of having a highly competent Evaluation Research community -- and thus the importance of system-facilitation within the function.

3. Orchestration as the Major NIE Role

A. The Need for System Orchestration

The functional analyses have indicated from a number of perspectives, the need for a system-wide and system-oriented agency (i.e., NIE) to provide orchestration for the educational R/D&I system as a whole. Such orchestration is needed because of: the system's immaturity; its variability; the differences in perspective among system members (e.g.,Users vs. Researchers); the interdisciplinary nature of education; the need to balance strategies in relation to the Dissemination function.

Given the need for orchestration, system monitoring becomes a key aspect of the orchestration process.

B. The Agency vs. Field Issue

When the primary role of NIE is seen as system orchestration, the Agency vs. Field issue changes (or even loses much of) its meaning. Given that NIE must provide a system-orientation leadership with a key emphasis on system building, and given our understandings of the various system functions (as discussed in previous chapters), we can see that the real issue is simply who can do what best at what given stage in the development of the total system and its functions, and bearing in mind the long term system building needs. This is often a fine dilemma, one that calls for subtle leadership. Thus, orchestration of both its own and field roles becomes the form of NIE leadership.

C. Functional Area Differences

Basic Research

In Basic Research, Agency orchestration entails:

1. selecting Research areas from among all the possible Research areas that might be funded (i.e., "placing bets");
2. finding and supporting quality activities going on in the field (especially the work carried out in centers of excellence possessing the necessary minimum critical masses of talent).

Such orchestration can be carried out effectively by an agency only if it is staffed by competent Researchers who are actively involved in the conduct of Research, and are sensitive to shifts in the field and emergence of new Research areas. Basic Research cannot be orchestrated and monitored through tight specifications. Rather, it requires the presence within the Agency of researchers who are an integral part of the field. Advisory panels can be used but cannot be relied on alone. Given this close Agency/Field relationship and the active involvement of researchers in the field, the Field-Initiated vs. Agency-Directed issue tends to melt away. The role of NIE becomes one of selecting from a field in which the Agency is closely integrated.

Problem-Focused Research

Agency orchestration in Problem-Focused Research involves:

1. mediating the tensions between the Research and Development perspectives, between Researchers on the one hand and Funders and Users on the other, and between the perspectives of the different disciplines;
2. orchestrating problem selection in terms of the oft-conflicting criteria of User needs vs. researchability;
3. orchestrating the types of institutional settings in which the Research is carried out (e.g., large scale settings in the private, quasi-public and academic sectors);
4. monitoring the Research process to make certain that the problem focus is maintained.

As in Basic Research, monitoring of tight output specifications would be an inappropriate form of orchestration.

Development

Orchestration for the Development function is a very complex matter, both because of complexities within the Development function itself and because Development activities must be orchestrated closely with other functions.

NIE must orchestrate a number of system linkages: Development/ Production linkages; linkages between the Developer and the state of the art; linkages between a variety of Development institutions; linkages to insure User input throughout the Development process.

NIE must orchestrate the proper roles of NIE and the field in Development; i.e., insuring field input in project selection and evaluation, orchestrating the selection and placement of advisers, emphasizing NIE responsibility in project and system orchestration. Project selection in particular requires an NIE orchestration role simply because there are so many needs and possible projects -- i.e., more needs than can possibly be met and thus more potential projects than can be funded. Further, the variety of needs indicates a consensus building need, which only NIE could orchestrate.

During the Development process itself, NIE must orchestrate the various stages in the process and monitor for quality control throughout the process.

NIE must also orchestrate a balance between the various modes of Development; i.e., the specialized Development organizations vs the practice-based vs. the technological-opportunity-based modes.

Finally, NIE itself must know what does and does not exist in the field and what NIE itself can and cannot do effectively.

Dissemination

Orchestration of the Dissemination function is also very complex, but has the distinctive characteristic of having a User focus.

In the first place, orchestration of Dissemination will be complex simply because of the nature of the Dissemination function. Because Dissemination is by definition a linkage process, NIE must orchestrate the way the Dissemination function informs Users, enables Users to utilize innovations, and enables Developers to know what Users need. Because Dissemination is a systems-creating phenomenon, orchestration of R/D&I system designing becomes a part of orchestrating the Dissemination function. Finally, NIE must orchestrate the transforms between Dissemination and the other functions.

Secondly, orchestration of Dissemination will be complex because of the variety of possible and desirable Dissemination mechanisms. Not only is there no single "right" Dissemination mechanism; a variety of Dissemination mechanisms is needed to provide "fail-safe" for the system itself. Dissemination strategies will likely consist of a combination of Dissemination mechanisms and methods. There will be a variety of intermediary organizations involved in Dissemination. Finally, there must be a "fit" between the "what" (products) and the "how" (Dissemination mechanisms).

Similarly, the size and variety of the User market will complicate orchestration. Further, orchestration of Dissemination must allow for Dissemination to be initiated either by the User or by the Disseminator.

There are some mandatable features within the Dissemination function (for example, allocation of resources to their markets) which must be orchestrated with the variety of more naturally energizing Dissemination mechanisms. The natural complexity of the function and the need for a variety of Dissemination mechanisms and approaches will require an ongoing NIE monitoring role.

Evaluation Research

Orchestration of the Evaluation Research function has three key characteristics: it will be very complex; it must be done in a value-laden political context; it must be done well.

Orchestration of the Evaluation Research is complicated first because there are many different potential Users and participants. Program administrators, Funders, Evaluation Researchers and the public will all have different data needs and interests -- thereby raising the issue and problem of data aggregation.

Further, there are three possible uses or purposes of Evaluation Research:

1. formative --- i.e., to provide project management with feedback to help control a project while it is still in process;

2. summative -- i.e., data upon which the policymaker can base future decisions.
3. knowledge production -- i.e., adding to the data base of the educational sector and the R/D&I system.

The above considerations raise a further issue for orchestration of Evaluation Research -- i.e., control over outcomes. This is a political issue in the sense that various persons may attempt to reject, modify or suppress findings; or may seek to use findings "out of context" for political purposes. Control over outcomes is also both a practical and a theoretical issue. The project manager may need feedback during the life of a project, but:

1. the Researcher may not wish to provide findings which are only tentative and may be in error;
2. feedback data may change the process and therefore make impact Evaluation Research difficult at best;
3. The manager will likely not want the feedback data to be made public for fear that it may instigate dysfunctional interventions in the project before the project has "matured."

The above discussion leads to three key orchestration needs:

1. orchestration to resolve potential political issues at the design stage of Evaluation Research to the extent feasible;
2. orchestration of control over outcomes to attempt to minimize feedback made public during the life of a project but that both feedback data and final report data will become public after the conclusion of the project;
3. orchestration of the tension between the need of summative Evaluation Research or "pure" data and the fact that the feedback process of formative Evaluation Research introduces process changes which make "pure" impact Evaluation Research difficult at best.

From this discussion, we must conclude that the demands on Evaluation Research are great. Monitoring will be a key part of Evaluation Research orchestration.

As if this were not enough, Evaluation Research orchestration must also include:

1. the different types of Evaluation Research skills needed for standardized as contrasted to highly innovative programs;
2. the different stages of Evaluation Research which require different types of Evaluation Research skills and which thus may be done by different organizations;
3. the issue of having the person who does the operational Evaluation Research (and may therefore no longer be objective) also do the impact Evaluation Research (and if not, as is often so, to orchestrate the two sets of Evaluation Research).

III. A COMPARATIVE ANALYSIS ACROSS FUNCTIONS: SOME OTHER COMMON THEMES

1. Varied But Close Agency/Field Relationship

We have tended to stress close Agency/Field relationships throughout our analysis. Illustrative of the range of relationships we see as possible are those that would entail such Agency actions as initiating R/D&I activities, or coordinating, mediating, facilitating, supplementing, or evaluating R/D&I activities already operative in the field.

There is, of course, at least one more option -- that of mandating where the field will not or cannot do something that is needed. Even here, the Agency would need to have a fairly close working relationship with the field to be in a position to know what the field will not or cannot do. This Agency/Field relationship will vary across the functions.

Research

In Research, the relationship between Agency and field needs to be closest of all functions. It calls for involvement of Agency personnel in Research activity so that they can function as an integral part of the field, and it suggests the wisdom of a strategy of collaborative/interactive Research planning by Agency and field together. Under such conditions, the Agency vs. Field issue melts away.

Development

Development calls for a supportive style of relationship between Agency and field, with Agency personnel facilitating quality activity where it exists and building or renting additional Development capacity where it does not exist at all or exists at too limited a level.

Dissemination

Dissemination is the exception to the general theme of needed close relationships between Agency and field. Given the large and fragmented nature of the field as defined by this function, there is no way the Agency can relate directly to the field. Instead, the Agency must relate to the field through directing or facilitating the work of intermediaries.

Evaluation Research

The political necessity that Evaluation Research be done well and the Research aspect of Evaluation Research both indicate that NIE personnel must maintain a close working relationship with the strong talent in the field.

2. Multi-Purpose and Portfolio Emphases

In all of the functions, we have emphasized that each individual procurement should be examined not only in terms of its manifest purposes but also in terms of additional ways the project could or would be likely to impact various parts of the R/D&I system. A premium should be placed on those projects which not only have important manifest purposes but which can also provide multiple additional impacts on the system.

Similarly, the cost/effectiveness of a given project should be evaluated in terms of its overall impact upon and within the total portfolios of projects and programs at NIE, across funding agencies, and within particular performer organizations.

Research

The key to effective Research procurement is the development of a bet-placing portfolio. The substantive Research outputs being procured must be recognized as having potential long term importance, with a very significant aspect of any procurement for NIE being its system-building potential. Thus, a Research portfolio must be understood as an area portfolio (a portfolio of

Research areas in Basic Research, problem areas in Problem-Focused Research).

Development

Development portfolios must balance high-risk and low-risk projects, short-term and long-term activities, etc. Since the substantive outputs of the Development function take on some more immediate substantive importance in their own right, this balancing of multi-purposes takes on particular significance. Wherever possible, potentially synergistic projects should be funded at the same time (either by a single agency or in coordination with other funding sources). Additionally, multi-purposes should be served explicitly wherever possible and balanced adequately in an agency's overall Development portfolio. Finally, it is vital for a funding agency to be sensitive to the manner in which its funding decisions shape the character and capabilities of the Development organizations with which they work.

Dissemination

In all other functions, we have suggested that portfolio/multi-purpose effects be considered along with the manifest purposes of a particular procurement. Because of the system-building nature of Dissemination, portfolio/multipurpose effects must be considered as an inherent part of the manifest purposes of each procurement.

Evaluation Research

In Evaluation Research procurements, consideration must be given to portfolios which are likely to have long-term system building effects. One key question, for instance, would be whether the bulk of Evaluation Research funding is flowing to those institutions most likely to produce high quality work and develop long-term capabilities, or whether instead it is flowing to organizations less likely to meet these needs -- and what this suggests about any weaknesses of Evaluation Research procurements as currently structured.

Additionally, consideration must be given to balancing the varied needs of project managers, funders and Evaluation Researchers.

Finally we must note that Evaluation Research is inherently multi-purposeful. That is, it has the three functions of: (a) meeting information needs of project managers; (b) meeting information needs of funders; and (c) adding to the overall knowledge base of the education sector.

3. Staging

Procurements might be designed in such a way that the carrying out of an overall project is broken down into stages (within and between functions), providing the Agency with the option to award different phases of the overall contract (e.g., prototype design/Development/field testing/Dissemination) to different contractors with different strengths, or to at least provide the possibility for field as well as Agency input and review at each step along the way.

Research

Research: In Basic Research, staging strategies are likely to be irrelevant. In Problem-Focused Research staging may be slightly more feasible, e.g., by separating into two stages the Need/Identification/project selection process from the actual conduct of the Research.

Development

The issue of quality control provides the basis for staging in the Development function. On the one hand, quality control is vital to ensure that Users will be able to obtain "good" products and thus will develop trust in the R,D&I system. On the other hand, we have noted the field self-quality control is weak. Thus, NIE must provide for quality control through the creation of mechanisms for monitoring of the various stages of the Development process.

Dissemination

The system linkage nature of Dissemination and the multiple-component nature of effective Dissemination strategies lend themselves to a staging process.

More importantly for NIE, building the Dissemination system in stages may be both wise and necessary because of the combination of: (a) the very large size and the variety of the User target group; (b) the cost of building a Dissemination system; (3) the weakness of our knowledge about Dissemination as a total process; (4) the need to build "fail-safe" into the Dissemination system.

Evaluation Research

As noted earlier, the relative variability of the Evaluation Research community -- make staging necessary. The political context makes staging seem a particularly advantageous strategy. Each stage of the Evaluation Research process requires different skills. The Research design stage is most critical of all and requires bringing in the best design talent available to design methodologically sound studies able to withstand the inevitable attacks on unpalatable findings -- often attacks that are political in nature but are couched in methodological terms. The design stage also seems to be the critical point in the process for identifying, orchestrating and taking into account the diversity of value-laden viewpoints that are likely to perceive a stake in the definition of "suitable" Research questions and determination of "appropriate" methodologies -- to make certain that what any stakeholder might perceive as unpalatable findings is not predetermined by prior choices of focus and methodology.

Whereas in the design stage, the best design talents would seem to be required, the picture is rather different in the data collection phase, where substantial numbers of competent organizations are available and competitive procurement is likely to be appropriate. In the data analysis stage (and perhaps too in a subsequent data reanalysis stage), the best minds would again seem to be called for -- here the best analytical minds.

Staging in this manner is likely at this time to produce work of far better quality than awarding a single contract for conduct of the whole process. Further, there is likely to be a substantial by-product in the form of strengthening communication mechanisms in the field (e.g.: among the best analytical talent) and enhancing the cumulative development of the knowledge/technology base of the field.

4. Process vs. Product Management Approach

Given the uncertain character of the field's knowledge/technology base and the professional training and socialization of the available personnel, a tight mode of management of R/D&I activities is often not feasible. A more reasonable alternative than tight monitoring of the R/D&I output or product is monitoring of the R/D&I process. This becomes an especially effective mode of management if NIE staff function as an integral part of the field while also stimulating the field's development of self-controlling mechanisms that make an Agency role in quality control less and less relevant over time as the system matures.

Research

Given the uncertainty inherent in the Research process, there is simply no way that the Agency can control the Research output. Rather, control over the Research process is more appropriate and more feasible -- and is most likely to be carried out well if Agency personnel are involved in Research activities, function as an integral part of the field, and have close relationships with the field. In Problem-Focused Research in particular, where the scale of the Research is likely to entail a considerable Agency investment, the need for control is high -- especially since the capability of the field is not well developed. However, since this is Research it cannot be controlled bureaucratically. The process mode of management seems essential, but this does require internal Research capabilities within NIE and a pattern of relationships with the field that do not yet appear to be the general rule within the Institute.

Development

In relation to the Development function, the process mode of management involves controlling who does Development work (through project selection) and to some lesser extent how it is done through the Agency involvement in some aspects of process design.

Dissemination

In Dissemination, the process mode involves control by steering, guiding and overseeing the Dissemination process.

Evaluation Research

The process mode of management within the Evaluation Research function involves exercising control at key points in the process. For example:

1. intervening during the design stage to insure that differing value-laden perspectives are taken into account in the initial definition of the questions to be investigated and the approaches to be used; that evaluation questions are researchable; and that Research designs are methodologically sound and likely to lead to clear answers to the questions under investigation;
2. controlling the types of Evaluation Researchers selected to carry out particular Evaluation projects -- with the more innovative (as opposed to the more conventional) programs calling for the kinds of Evaluation Researchers who are creative and who also have an in-depth understanding of the particular kind of program being evaluated.

5. Facilitating, Buying, or Renting

Where needed capabilities exist to some degree within the educational R/D&I system, a facilitating/collaborative strategy is possible for NIE. However, where specific needed capabilities do not exist (or are too few), NIE is forced to be more directive. In that case NIE's options would seem to be to "buy or rent" the needed capabilities. The "buying" strategy would involve a direct attempt to create institutions with the needed capabilities that would become permanent and largely committed parts of the educational R/D&I system. A "renting" strategy would entail the temporary purchase of services from organizations that already posess the needed skills but are external to the educational R/D&I system in that their involvement tends to be limited and/or of short duration. In this case, a "gap" in the system is "filled", but only temporarily, on a project-by-project basis. The advantages of the "renting" option are that the needed capabilities are available immediately, NIE can be rather directive about what is to be done, and the funding need be only short, specified periods. The disadvantage is that this option does not increase the overall long-term capabilities of the system.

Renting may be a preferred option in the case of highly specialized or seldom used capabilities that need not be developed internal to the system. Additionally, renting may be a useful interim strategy -- so long as its use does not retard system development because the outputs of the emerging internal capability are not as polished and professional as those likely to be produced by external organizations with well developed capabilities that can be rented.

Research

Research: In Research "buying" strategies tend to be most appropriate at this time since the primary consideration in Research procurements, we have suggested, is system building. While renting is perhaps not a very apt description in this instance, cases of attracting Researchers from other fields into educationally relevant areas for relatively short periods would be analagous to renting. This has been going on in education but should not be a major strategy.

Development

In Development, renting or buying are Agency options, especially with regard to the generalizing, packaging, production, and dissemination of exemplary programs developed in practice-based settings. The renting option permits rapid packaging and dissemination. The buying option builds long-term internal system capabilities. Mixed renting/buying strategies are also appropriate.

Dissemination

In relation to Dissemination the need to build the system and the likely high costs of renting suggest the advisability of buying strategies. However, the easy replicability of some Dissemination modes permits and even favors renting options under certain conditions. Mixed renting/buying strategies may be particularly appropriate at this point in the system's development.

Evaluation Research

Here, too, there are options. However the strong system facilatating and building needs suggest the advisability of emphasizing buying strategies as the preferred alternative at this time, even though opportunities of making use of highly qualified and specialized organizations need not be abandonned as part of staging strategies.

6. Mixed Strategies

Where the state of knowledge about a function is low, it may be most appropriate for an agency to pursue mixed strategies that provide alternative possibilities and a fair amount of redundancy that is orchestrated subtly rather than being "over-coordinated" or "over-managed". Often advisable is a policy that permits a substantial degree of natural variation along with built-in mechanisms for monitoring natural field experiments and using documentation-and-analysis Research to develop a stronger knowledge/technology base for the field.

The need for mixed strategies gets stronger, the closer one gets to the User end of the R/D&I continuum, with mixed strategies being essentially mandatory in relation to the Dissemination function.

Research

The use of mixed strategies is likely to be minimal in Basic Research, where "placing bets" on specific Research areas is likely to be the primary strategy used. There are more options in relation to Problem-Focused Research; e.g.: using small and large organizations; strong NIE personnel and advisory panels from the field.

Development

Mixed strategies are highly appropriate to the Development function; e.g.: mixing use of staging options; single vs. multiple institutions; specialized Development organizations vs. practice-based Development; practice-based vs. technological-opportunity-type Need Identification; production by Developers vs. Users; etc.

Dissemination

In Dissemination, the use of mixed strategies is mandatory given the variability among products, User needs, User capabilities, etc.. Mixed strategies are particularly appropriate here since there is clearly no one "best" mechanism and many mechanisms exist or can be created. Use of mixed strategies is the essence of designing fail-safe systems.

Evaluation Research

The use of mixed strategies here is limited somewhat to staging and to selection of different types of Evaluation Researchers (e.g., for evaluation of more innovative vs. more conventional kinds of programs). The primary strategies must be: (a) resolving political issues in the design stage; and (b) providing a balance among differing information needs.

IV. A COMPARATIVE ANALYSIS ACROSS FUNCTIONS: SIGNIFICANT DIFFERENCES

1. Time Frame

Research

The time frames for Basic Research projects tend to be rather long, while those for Problem-Focused Research may be somewhat more moderate. Further, since Research involves a high level of uncertainty, the Research time frames are generally not predictable. System building for both variants of the Research mode tends to take considerable time -- both to identify and train creative Research talent within existing centers of excellence and to build Research teams with the needed longevity for productive relationships. The rate of expansion for both variants of Research is limited by the number of such existing centers and their capacity to train additional personnel and absorb and use additional funds productively.

Development

The time frame for Development projects tends to be short to moderate in length and relatively more predictable.

Dissemination

Dissemination involves a very different concept of time. It requires consideration of the interrelationship between two different time lines -- the rapid rate at which Dissemination capacity can be expanded and the much slower rate of User absorption and utilization of what is disseminated. To avoid unrealistic expectations for system impact, the rate of Dissemination capacity building must be regulated to keep it reasonably congruent with expected User absorption rates. Another option of course is to facilitate the work of organizations that provide the kinds of User system technical assistance and support that might increase somewhat the rate of User absorption and utilization.

Evaluation Research

This Function tends to have extremely tight, highly specified time lines tied to the information needs of decision makers and the time frames of their decision processes. Since evaluation findings are gathered for immediate usage as input to these decision processes, the time lines are major constraints on the Evaluation Research process and cannot be shifted at the initiative of the Researcher. They may at times be even shortened at the initiative of the client, as in the case when information is needed more quickly than the time frame initially specified in the Evaluation Research procurement. Consequently, the need for interim reports becomes a matter of some importance as does the design of Research procedures that permit staged gathering of information and formulation of findings.

There is often a tension in Evaluation Research between the immediacy of information needs for decision inputs and the long-term nature of what is being evaluated -- more often than not the slow change process experienced by individuals, social groups, and communities. The more socialized the Evaluation Researcher has been in other modes of Research (especially Basic Research but Problem-Focused Research as well), the more tension is likely to be produced by the time frames demanded by the Evaluation Research context.

2. Excellence

Research

In Research, Excellence is the key criterion of judging projects and institutions. In Basic Research, Excellence is defined in terms of creative, productive, rigorous activity at the outer limits of the state of the art. In Problem-Focused Research, the same definition applies, tempered to some extent by standards of practicality.

Development

In Development, Excellence is defined in terms of what is feasible, practical and usable, not by the outer limits of the state of the art.

Dissemination

In Dissemination, Excellence is defined in terms of effectiveness and professionalism.

Evaluation Research

In Evaluation Research, a substantial amount of tension surrounds the Excellence issue. On the one hand, it has to be done very well (although not in terms of the Evaluation Researcher seeking to break the outer limits of the state of the art). However, the immediacy of information needs poses serious constraints on what the Evaluation Researcher can do. Excellent work that is concluded too late to affect decision processes is not useful. Consequently, the Evaluation Researcher must produce the best work possible within specified time constraints. Interim reports in particular may need to be judged with a different standard of excellence from the standard used to judge a final report.

3. Key Criteria for Project Selection

Basic Research

For Basic Research in education at this time, the project selection process calls for:

1. placing bets on Research areas that are likely to bear fruit; accepting the fact that there is likely to be no one "right" project; and becoming comfortable with a degree of opportunism in the selection of Research areas (particularly being opportunistic about the Research strengths of the NIE Research staff);
2. searching for centers of excellence possessing the needed critical masses of Research talent; and
3. viewing system building considerations as paramount in project selection.

Problem-Focused Research

In Problem-Focused Research, project selection criteria must include:

1. insuring the existence of an adequate problem focus;
2. insuring the interdisciplinary nature of the perspectives brought to bear, as needed;
3. insuring the longevity of team commitment to the problem area.

Longevity is also important in Basic Research, but tends to be less of a problem because of the nature of many of the better Basic Research personnel and their personal commitments to areas of Research.

Development

In selecting Development projects, the Agency must start from a posture of accepting the potential equivalence of an array of alternative projects. Thus, selection criteria must focus on:

1. whether the projects fall in the priority areas
2. whether or not the contractor has the needed capabilities; and
3. likely system impacts in terms of system-building, multi-purpose, and portfolio considerations.

Dissemination

The key project selection criterion in Dissemination are:

1. cost/effectiveness in relation to multi-purposes and portfolio effects;
2. providing for fail-safe.

Evaluation Research

In Evaluation Research, project selection criteria include:

1. researchability;
2. likelihood of providing information in a form that is reasonably immune to methodological attack to serve political purposes; and
3. system-facilitation considerations.

V. A COMPARATIVE ANALYSIS ACROSS FUNCTIONS: NON-PROCUREMENT STRATEGIES AND NIE PERSONNEL

1. Non-Procurement Strategies

We have noted that NIE should consider three general types of strategies: Procurements, Non-Procurement Behaviors, and Internal NIE actions. The common themes we have been considering are primarily procurement-related but can also involve non-procurement behaviors. For instance, we have mentioned at several points the possibilities for NIE to orchestrate and coordinate funding across the various funding agencies -- e.g.: federal agencies; funding from other levels of government; and other potential private sector sources of funding. Multi-purposes and portfolio emphases are as appropriate to the funding coordination process as to the examination of individual procurements or Agency program agendas. Coordination of funding may be used to illustrate non-procurement strategies across functions.

Research

In Research, cross-agency coordination is vital because much educational Research is likely to be interdisciplinary in nature. Further, while the proportion of total Research funding provided by NIE is small, NIE is the lead agency.

Development

In Development, coordination of funding across agencies is likely to be helpful but is not so essential. It may be adequate simply to know what kinds of Development projects other agencies are funding and therefore where the potential for synergy may exist.

Dissemination

In relation to Dissemination, coordination across agencies may be helpful. However, OE rather than NIE is the lead agency for activities that relate to the operating system. Consequently, NIE may have to work very closely with OE in these coordination activities.

Evaluation Research

Given the extensive amount of Evaluation Research activity that is supported by federal agencies and other levels of government, coordination of such funding would seem to be helpful both for orchestration purposes and also for developing a cumulative knowledge/technology base for the Evaluation Research function.

2. NIE Personnel

We have noted that to orchestrate, monitor, and relate to the field in each function, NIE needs to have personnel with specific types of skills and backgrounds.

Research

If NIE is to relate to the field in the manner we have suggested, it will be essential for NIE to have on its staff Researchers who are from the field and who continue to be involved actively in the Research process. This would seem to be an essential requirement for effective NIE process monitoring and orchestration of the field, and even more critical if Research planning is to be carried out in an interactive/collaborative mode. We have suggested that the kinds of Researchers needed here are not the "stars" of the field who are likely to distort the field to their own image of where the field should be. Rather Researchers are needed who can facilitate and work with the field, who are sensitive to developments going on throughout the field. These requirements would seem to contribute significantly to the case for NIE conducting a limited in-house Research program not in competition with but as a contributor to the field.

Development

The kinds of NIE personnel needed to manage the Institute's Development programs would seem to be education professionals sensitive to the needs and constraints of the education context and who also possess the kinds of skills needed for effective orchestration and facilitation.

Dissemination

If the Dissemination function is to be carried out in a highly professional manner, it would seem advisable to have at least some Dissemination professionals on the staff of the Institute -- talent that can likely be "rented" temporarily or acquired on a more permanent "buying" basis.

Evaluation Research

The internal Agency skills needed here would seem to be political as well as methodological insight and savvy regarding such matters as different ways of defining problems; the different kinds of Research methodologies that are relevant to different kinds of projects; the varying needs of program managers, funders, and Evaluation Researchers; and the relevant potential political implications. Most likely this mix of skills is to be found only in experienced, first-rate Evaluation Research talent.

In concluding this section we feel that it is appropriate to echo a theme first raised in the Preface. NIE priorities and responsibilities can not be only a reflection of the Agency's budget profile. As a small agency in a large field its activities as coordinator, orchestrator and facilitator, involving non-procurement based efforts are likely to have very significant implications for the short and long term health and functioning of the educational R/D&I system.

3. Structures

A cross-sectoral comparative analysis reveals some differences across functions in the forms of NIE organizational structures that would be most relevant to each function.

Basic Research

The uncertainty involved in working at the outer limits of the state of the art is the key to determining relevant NIE structures in relation to Basic Research. NIE cannot orchestrate, guide and monitor this field from centralized structures and detailed plans. Rather, NIE needs to have personnel who know the field: what is being done, where and by whom, in order to determine which areas of concern to concentrate upon and which personnel and institutions to support in a long-term system-building mode. These conditions suggest decentralized, emergent-organic structures, with generally open boundaries between NIE and the field such that NIE personnel are actually a part of the field. This would seem to call for a relatively loose distinction between NIE/field organizational membership for NIE personnel -- for example, as might be achieved through personnel interchanges and leaves to and from universities (as is now occasionally done).

Problem-Focused Research

In comparison to Basic Research, there is relatively less uncertainty in Problem-Focused Research, though this is still a significant factor. The boundaries between NIE and the field are clearer, but there remains the need for NIE personnel to be directly involved in Problem-Focused Research. Since both NIE and field personnel would be involved in Problem-Focused Research (though probably separately), the key element of structure becomes some form of linking mechanism between NIE and the field. A matrix structure might be relevant in terms of the interdisciplinary nature of educational Research and the various problem areas of Problem-Focused Research -- and to facilitate selection of institutions to support in a system-building mode.

Development

Development is not an in-house NIE function. NIE's role is to provide direction through funding and monitoring. Since Development is a product-oriented function, NIE might consider structures which are organized according to product typologies.

Dissemination

Because of the size and variety that characterizes education and because we generally cannot say there is "one best way" for all situations (or even for a particular situation), diversity and even redundancy characterize Dissemination. Thus, there will be structural diffusion -- i.e., several different structures may emerge in the field and be supported. NIE structures must be supportive of, and congruent with, field structures. One relevant NIE structure could be a problem/geographical matrix organization.

Evaluation Research

The key needs for Evaluation Research are (a) orchestration of a complex set of needs, relevant participants and perspectives; and (b) insuring that Evaluation Research is done well. This situation presents a key structural dilemma.

On the one hand, the politically sensitive nature of Evaluation Research requires that it be done well and that potential political issues be dealt with in the Evaluation Research process. Further, the various and possibly conflicting needs and perspectives of the participants require orchestration. Finally, especially with regard to summative Evaluation Research, it is the policymaker/funder who must and will determine problem definitions and Evaluation Research objectives. These conditions would seem to call for close control at a high level within NIE. This would also seem to call for top level NIE personnel to have both substantive and methodological skills and political savvy.

On the other hand, the Evaluation Researchers need to have a good deal of freedom in matters of Research methodology. Further, there need to be ways for the Evaluation Researchers to provide guidance in matters of problem definition and Evaluation Research objectives. Additionally, program administrators need to be able to obtain the information they need. These conditions would seem to call for significantly less control by NIE.

Perhaps it is best to say that NIE must insure that basic needs are met by the Evaluation Researcher (e.g.: that some level of basic Evaluation Research standards are met; that certain NIE-specified objectives are accomplished; and that the political issues are dealt with constructively -- but that beyond these basic requirements, there should be a good deal of freedom and flexibility within the Evaluation Research function.

VI. CONCLUDING REMARKS: COST CONSIDERATIONS IN RELATION TO POTENTIAL LONG-TERM INVESTMENT PAYOFF

We would be remiss in concluding this analysis without mentioning the costs likely to be incurred by the kinds of strategies we have proposed. In comparison to the procedures currently used, it is likely to be considerably more internally costly for Research programs to be developed through long-term, intensive, collaborative/interactive relationships between Agency staff members and the field. To take another example, staging of procurements (especially when this involves complex orchestration of diverse viewpoints in some stages) is likely to appear to be a more costly alternative than awarding a contract for the whole project to a single institution.

We acknowledge this cost factor. But we also point out that the considerable amount of NIE staff time currently invested in the researching and writing of RFPs was one of the concerns that prompted the Council and the Institute to request this policy analysis. The added cost may also be more apparent than real when this is offset by potential gains in productivity.

We have no way of putting a price tag on the kinds of options we have proposed. But if NIE accepts the mission and the role we have suggested, the costs will have to be absorbed and referenced in terms of both increased effectiveness and efficiency and the potential long-term investment payoff in building future system capacity. The point need not be labored further.

The case for NIE to assume system-oriented responsibilities is, we believe, a strong one, entirely consistent with its legislative mandate and its position as lead agency for Research and Development in education. We suggest that the rather fundamental and broad-ranging questions raised by the Council and the Institute, once subjected to analysis from an R/D&I systems perspective, demand at the very least thoughtful consideration of the case for a rather substantial restructuring of the Agency's relationships with the field.

SCENARIO ANALYSES

I. NIE-DIRECTED COMPETITIVE PROCUREMENTS: A SCHOOL DISTRICT SURVEY

1. Description of the Procurement
2. Impacts
3. Evaluation of the Procurement and its Impacts, Actual and Potential
4. Possible Alternatives
5. Summary Description of Alternative Procurement and Related Activities
6. Likely Impacts

II. UNSOLICITED PROPOSALS: A PROPOSED FRAMEWORK FOR DESIGN OF NATIONAL PROGRAM EVALUATIONS

1. Description of the Procurement
2. Impacts
3. Evaluation of the Procurement and its Impacts, Actual and Potential
4. Possible Alternatives
5. Summary Description of Alternative Procurement and Related Activities
6. Likely Impacts

SCENARIO ANALYSES

INTRODUCTION

Two illustrative scenario analyses follow:

1. an examination of the implications of alternatives to NIE-Directed Competitive Procurements, where less competitive modes might seem more appropriate; and
2. an examination of the unsolicited proposal as a procurement mechanism and options that might be considered in funding R/D&I activities initiated through the unsolicited route.

Consideration of these two issues in particular was requested by NIE staff.

The specific scenarios we have developed both concern procurements of Research. In part, this is because both issues seemed to lend themselves to richest illustration in the Research context. But also, it seemed to us that Research thinking is central to NIE procurements as they are made currently. If we could be persuasive in making a case for system-oriented thinking in relation to the Research function(where much of what we have been suggesting might seem particularly alien), then it might be even easier at a later date to make a case for this pattern of thinking in relation to other functions.

Each scenario is presented in accord with the analytical model described earlier in our introductory chapter (see pp. 19-21 and especially Figure 3):

1. a description of a procurement (in both cases these are hypothetical procurements but based to some degree on typical cases);
2. analysis of the likely impact of a procurement implemented that way, given the educational R/D&I context at this point in time;
3. evaluation of the possible strengths and weaknesses of the procurement based on the above analysis;
4. development of alternatives to (or modifications of) the initial pattern of procurement that might better achieve Agency purposes;

5. description of the modified or alternative procurement approach, its latent and manifest purposes, and its implications for non-procurement activities and actions within NIE; and
6. analysis of the likely impacts of this alternative pattern of procurement.

It should be noted that both scenario analyses presented here were hypothetical rather than actual cases. Clearly, the scenarios would be more useful if they were based on actual cases of NIE procurements -- past, present or contemplated. We would have preferred to develop a series of scenarios based on actual cases. However, this would require some discussions with NIE project officers and other NIE personnel, as well as analysis of relevant documents and perhaps too, discussions with others outside of NIE involved in the planning and/or implementation of the particular procurement. We would hope to conduct such empirically-based scenario analyses some time in the future if NIE judged this to be desirable.

I. NIE-DIRECTED COMPETITIVE PROCUREMENTS: A SCHOOL DISTRICT SURVEY

1. Description of the Procurement*

In 1975, NIE issued an RFP for a survey of 2000 school Districts. The objective was to be able to identify those school Districts that may have had some involvement in locally generated innovation. The survey was to gather basic descriptive data on these school Districts, who they were and what kind of things they had done, size, age, location, personnel, student population, SES characteristics, etc. -- so as to develop a better understanding of the conditions which affected the innovation behavior of those school Districts that would be so identified in regard to both internally and externally developed innovations. One of the central questions of concern was whether these particular school Districts, having already demonstrated some capacity for self help might not represent a highly receptive and possibly qualified population for R&D products that had been developed externally. If so then, potentially, these Districts might well merit becoming the target of more intensive dissemination and technical service efforts to supplement their own. In turn they might become the source of model programs, of exemplary practices.

On the other hand, it was also possible that, given their own, self generated efforts they would be resistant to innovations deriving from external sources (the Not-Invented-Here syndrome). Further, it would be important to know whether such conditions held generally (or not) across the total population of such school Districts or whether they might vary with respect to such factors as:

size
urban/rural
minority concentration

---

*While the case is presented to read as though it describes an actual NIE procurement it is in fact hypothetical. Also the authors imply no position on the substantive content of the procurement.

professionalism of staff
District structure etc.

Critical dependent variables to be observed as indicators of potential receptivity might be:

scope of adoption behavior (rates, scale, etc.)
maintenance after initial trials
observable levels of institutionalization (e.g., after periods beyond 3-4 years)

The study was seen as the first step in what might become a long term survey program aimed at monitoring these effects so as to permit a responsive strategy on the part of the various delivery and diffusion mechanisms that might be operating in relation to these Districts. Thus, this initial survey was viewed as a critical first step that would develop the sampling frames that would permit improved later studies and also both natural and planned field experiments (e.g., to examine alternative dissemination and/or technical assistance strategies), as well as to permit experimentation with varying modes of Development (e.g., specialized Development Organizations vs. Practice-Based).

The core of the issue was how local innovation activity interacted with external based R&D. A particular sub-concern involved the special case of "Basic Skills". How might the conditions implied above affect the likely response to products being developed in this area in the R&D system and, relatedly, what could be done to make such products or programs more adoptable and useable by this type of potentially very important target (in terms of the planning of a major development and delivery program)?

The survey was to be conducted in two phases

Phase 1 - Survey of the 2000 Districts selected as a carefully statified sample of the total population. The objective of this phase was to identify which of the Districts had exhibited what kind of internal innovation behaviors, and their behavior with respect to externally based R&D products.

Phase 2 - Was to be a more intensive survey of the sub-group identified in the phase 1 survey as having had a history of some significant internal innovation activity. The objective of this phase was to increase our knowledge of the nature behavior and attitudes of such Districts. The size of the second sample would be determined based on the phase 1 findings --but with the hope of having a population of some hundreds.

Based on the two phases it was hoped that the characteristics of school Districts likely to have been involved in different kinds of innovation, with varying intensities, could be identified, as well as specifically identifying a sample known to have been engaged in such practices. Further, some specific indications might then be obtained as to the responsiveness of this sub-group (and hopefully therefore of the larger group of school Districts that had demonstrated self-help capacities).

The primary purpose of this procurement was substantive -- i.e., to gather the desired data. But there were other purposes involved as well: system-oriented purposes (in terms of developing baseline data for system monitoring and developing a listing of innovative school Districts) and environmental purposes (e.g., demonstrating that the program was responsive to the many and diverse concerns that had been expressed by associations of Chief State School Officers and other LEA personnel who would make up a substantial proportion of the overall survey population).

A point to be noted about this procurement is the extent to which it partakes of characteristics of both Problem-Focused and Evaluation Research (or Policy Research). It was intended to increase our understanding of a potentially important group of Users/Innovators in the educational R/D&I system (about whom we know relatively little at this time), to permit NIE to carry out its system management role more effectively. And too, it was oriented toward meeting information needs of policymakers suggesting an opportunity area in the system in need of NIE policy initiatives, and providing the beginnings of a time-series data base against which to evaluate the impact of the Institute's policies and programs. Consequently, such a procurement would seem to call for a balancing of the requirements of both Problem-Focused and Evaluation

Research -- a tension not easily mediated between a) the creativity needed to develop a useful picture of a little understood system and b) Agency specification of the key information needs to be met.

In the case of this particular procurement, the Agency issued a highly specified RFP -- specifying the variables to be studied, the questions to be answered, etc. and requiring frequent and extensive, highly specified interim reporting in accord with a specified schedule. A considerable amount of NIE staff time was invested in the preparation of the RFP (as well as in the prior work to develop the stratified sample of the 2,000 school Districts to be surveyed in phase 1). There was some interaction with SEA/LEA sector representatives (whose cooperation was essential to achieving a high survey response rate), but little if any interaction between NIE and other highly knowledgeable participants in the educational R&D system -- this despite the fact that NIE had some contracts with a number of organizations studying aspects of the educational R&D system and specifically conducting surveys of school Districts -- perhaps out of concern that such interaction with these contractors with whom the Institute already had a relationship would be construed as giving them unfair advantage, -- a violation of the "fairness" principle so strongly clung to in government procurements, where all potential contractors in a system are expected to be given absolutely equal treatment in their relationships to the Agency. We shall return to this to this point shortly.

The RFP appeared to be a call for a single, well qualified survey organization to carry out a predesigned survey and provide prespecified data analyses. One month was allowed for the response.

2. Impacts

a) The Agency received a substantial number of proposals in response to the RFP, mostly from single contractors (rather than collaborative contractor/subcontractor arrangements), mostly proposing to carry out the work as specified rather than suggesting alternative types of surveys, mostly from large-scale private sector survey research corporations -- in short the competitive mode was reasonably successful in attracting a good number of the types of organizations considered most appropriate to carry out this procurement.

b) Costs: NIE invested considerable staff time in the stages preliminary to issuing the RFP and in the evaluation of proposals to select the survey contractor. Perhaps 20-30 organizations expended resources (equal perhaps to 1 to 2 man-months each) in responding to the RFP and in subsequent contract-related interaction with NIE.

c) The survey contract was awarded to a single highly qualified organization with strong survey capabilities and substantive knowledge of issues relevant to understanding the innovative behavior of schools and school Districts. Agency purposes, then, would seem to have been achieved well.

3. Evaluation of the Procurement and its Impacts, Actual and Potential

In evaluating the procurement, Agency personnel must weigh actual (or likely) impacts of a procurement as initially formulated with possible desired impacts. The question to consider here is: How might such a procurement be designed to better achieve Agency purposes, or to achieve a broader range of Agency purposes?

At the very least this question requires insuring some clarity on Agency purposes: What in fact are the Agency purposes that are viewed as relevant to this procurement? Might a somewhat different view of the Agency role and its requirements for procurement policies produce a different or an enlarged picture of the relevant purposes?

If (a) NIE's role is conceived largely as being a funding channel, with Agency leverage on the system exercised primarily through choices as to which work it funds, and if (b) the work to be procured is relatively straight-forward data-gathering in accord with the prespecified design -- then the procurement mechanism (the RFP) would seem entirely appropriate. However, if (a) NIE conceived its role primarily in terms of long-term system building, and if (b) the Agency started from the premise that the extent and processes of innovation in school systems are not well understood phenomena and that developing a data base for understanding such processes required the input of creative thinking from the R&D field and not simply more mechanistic kinds of conventional data-gathering (which is more appropriate to well understood phenomena) -- then other Agency procurement strategies become reasonable alternatives to consider.

If the survey is viewed as primarily data-gathering, i.e., to identify

a) a specific group of "self help" innovator schools

b) the structural and other characteristics of such schools

c) limited and minimal data on prior adoption behavior in the respect to external innovations

then competitive RFP-type procurement may indeed be the wisest course of action. Strong Research talent might be "turned off" by the RFP's specificity, but this might be quite appropriate since the Agency might view it as undesirable to divert strong Research organizations into conventional data-gathering of this type. Given the substantial number of competent survey research organizations attuned to RFP procurements who could effectively gather the desired data, Agency purposes would indeed be well served by use of a procurement mechanism likely to attract these survey organizations and not the strong researchers whom the Agency would rather see doing other kinds of work for which they are more uniquely qualified.

However, if the survey is thought of in terms of designing a data base and monitoring system that will be useful in the long run for developing an understanding of a weakly known and little understood group of school Districts, and developing the kind of understanding that will be useful for identifying policy-relevant leverage points as well as achieving a degree of system building, then it would seem that a case could be made for a different pattern of procurement that:

a) could attract strong Research talent to the design stage of the survey effort;

b) could have some impact on strengthening such strong Research institutions and shaping their long-term agendas and portfolios;

c) developing powerful communication linkages among the Research talent that might be considered an "invisible college" on school innovation processes and possible synergy or collaboration among their separate efforts, etc.; and

d) developing a close positive working relationship between NIE and this part of the field, with NIE's internal personnel coming to be viewed as an integral and key part of the field, facilitating quality work in the field and development of the field.

(If the procurement is seen in somewhat creative terms, then NIE should be fully cognizant of an impact that seems entirely likely if the work is procured as it was in a tightly specified RFP. Such procurement forces creative Researchers with procurement savvy and understanding of the complexity of the task they are undertaking into a form of game-playing with the Agency: contractors suggest that they will generally abide by the RFP's specifications -- for they will not otherwise win the contract -- while in their own minds they are fairly certain that the complexities of the task make such scheduling, specificity of outputs, etc. infeasible and likely to be modified substantially in the course of conducting the survey).

If NIE procurements in general came to be viewed in multi-purpose terms, and in relation to possible, supportive non-procurement activities and internal NIE actions, then the procurement might be carried out in conjunction with:

a) NIE initiatives to coordinate its survey with similar work elsewhere (e.g., in OE), to seek cross-agency collaboration, synergy, pooling of resources, exchanges of information, etc., and

b) internal NIE actions to promote a systems perspective among personnel in program units and to develop a pattern of cross-program communication and synergy that might strengthen Institute functioning as well as total NIE impact on the R/D&I system toward which its somewhat discrete programs are directed.

Thus for example, in this particular area a number of NIE groups would (or should) have substantial interest. These would include those concerned with Dissemination and Feed Forward processes, with R&D utilization, with local problem solving, with the overall R&D system and with Basic Studies, even though only one of these groups was actually involved in the procurement being discussed, and was in fact pursuing the project independently of the others.

4. Possible Alternatives

A. Developing a close working relationship with the strong talent in the field during the survey design stage:

Use of the RFP mechanism for procuring this work probably had the effect of cutting NIE off from the base of creative Research talent who tend to be "turned off" by RFPs -- who could not conceive of carrying out Research they did not themselves design (or at least play a role in designing) or in working within tight specifications as to deadlines, outputs, etc. Many of these Researchers may not even be aware of the existence of this Research program (so that they might think about participating) since they are unlikely to read the Commerce Business Daily or other such sources where competitions generally more attractive to entrepreneurial organizations are announced.

If the procurement is thought of (initially, or after the evaluation stage described above) as requiring input from creative Research talent -- to zero in on what kinds of things we need to study so as to achieve long-term policy-relevant goals (for example that might involve the exploitation of diffusion processes based on seeding school districts having high implementation success probabilities, based on their demonstrated self help capacities)* -- then perhaps the survey design stage could be viewed as a wedge for achieving a wider range of Agency purposes. By bringing the strong talent in the field together in an ongoing relationship with the Agency, NIE might use the design of this survey as the basis for long-term program planning of the Research program to be served by (and to further the development of) the monitoring system. This kind of relationship with the field might affect not only the long-term NIE Research program agenda/portfolio, but also influence the shaping of long-term agendas of these strong Research organizations. The greater the involvement of these organizations in the design of this long-term data system, the greater the likelihood that synergy will develop within and between their own organizations' Research agendas. Thus, this mode of relationship has the potential of being the wedge whereby NIE may shape the portfolios of the institutions that appear to have the strongest potential for producing important quality work in this area. The capability-building potential here may in fact have greater long-term consequences than the particular survey (or even the particular monitoring system) being designed.

---

*We wish to remind the reader of the hypothetical character of both the process described and our neutral position as to the substantive content.

If a survey of this kind is to be an element in a continuing process, some kind of ongoing close relationship with the field of potential contractors might be essential. Otherwise, each contractor carrying out a piece of the long-term program is likely to pursue its own conception of what is involved here (which may at times be appropriate, but within bounds of some sort), *or* NIE will be forced to be highly directive each and every time about the work to be carried out.

B. Staging the procurement with competitive RFP-type procurement used only in the data-gathering stage:

The procurement might be staged so that (1) R&D specialists work collaboratively with NIE during the design stage (either as "consultants" or as the result of modified competitions such as invitations to them to submit proposals of design ideas, etc.); (2) the larger scale phase 1 data-gathering stage is handled competitively through RFP-type procurement; and (3) the more intensive but smaller scale phase 2 survey and the data analysis and subsequent reanalysis stages might again be handled in only modified competitive form (e.g., inviting specific innovation process specialists to submit proposals) or as open competitions that include an element of actively encouraging certain organizations to submit proposals. With regard to the analysis stage, what we are suggesting may again come into conflict with the "fairness" principle. If some form of phase 2 and/or data analysis competition pits specialists involved in the design stage and/or the phase 1 stage against the rest of the field, it is highly likely that someone will cry "foul" and argue that any of those involved in the initial efforts should be barred from the later analysis competition because their knowledge gives them "unfair" advantage. The other possibility -- closing this competition to only those involved in the design stage (or perhaps specifically inviting them to bid) might produce even louder cries of "foul" since clearly they are being treated differently from the rest of the universe of potential competitors. The problem is not easily resolved.

C. Issuing a competitive procurement-announcement that uses the NIE-developed survey design as illustrative, and encourages creative design work and collaborative arrangements between organizations strong in survey research and others strong in understanding innovation processes

Another option rather different from what we have been suggesting would be to implement the procurement as a single procurement but change the specificity, time frame, etc. to make it possible for more creative design work to be carried out in the proposal development and to facilitate the development of collaborative arrangements among organizations with talents suited to different phases of the overall procurement.

It should be noted that while collaborative contractor/subcontractor arrangements were not prevented in the initial RFP, nor was a contractor prevented from suggesting an alternative design for the survey (in addition to bidding on the design specified), such possibilities were made somewhat difficult by the one month or less available to the contractor to draft the proposal. Collaborative arrangements take time to develop and complicate the problems of writing a coherent proposal. Furthermore, developing alternative conceptions for the survey -- different in conception, design, execution, etc. from what was suggested in the RFP -- is likely to be difficult if not impossible within the RFP response time frame, especially given the varied other demands on the time of those drafting the responses. In all likelihood, considerably more time was invested by NIE personnel in the development of the design specified in the RFP. Clearly, any organization responding to a competitive procurement is aware that investment of time and money in responding to an RFP is a gamble with payoff likely only in a fraction of all cases. Therefore, the time an organization is willing to invest in responding to an RFP is likely to be limited -- not sufficient to conceptualize, elaborate, and present well a design for an alternative approach significantly different from that specified in the RFP.

There are problems inherent in this option, then, and perhaps a staging here might resolve this -- e.g., competitively procuring brief statements of creative design work proposed, then selecting from these a small number of organizations to work with internal NIE staff to develop the designs within a reasonable time frame.

Coordination within NIE

Given the fact that the survey data to be gathered have potential utility across NIE program boundaries, and that some of the data needs of other NIE programs might have been met by this survey, then planning of this survey might have been used as a wedge to promote cross-divisional and cross-program communication within the Institute--to promote a more systems-oriented pattern of thinking across the Agency as a whole, especially to seek synergy and interaction effects across program lines. Clearly, the Institute would be well served by such a strategy.

4. Summary Description of Alternate Procurement and Related Activities

A. Staging/Field Agency Relations

The procurement could be usefully thought of as having the following possible elements:

1) the initial conceptualization and general research design
2) the first phase mass (2,000 school districts) survey
3) data analysis and the selection of the sample of "self-help" school district innovations
4) the second phase intensive survey
5) the data analysis for the second phase and possible reanalysis of the first phase data
6) design of alternative delivery strategies
7) design of potential field experiments.

While these elements would not all need to be so separated, it is readily evident that different skills are required as between various combinations of elements. Also, there are likely to be critical questions that will need answering at each stage before it will be obvious as to whether it is justifiable to proceed. Thus it will be only after element 3) above (the phase 1 data analysis) that we are likely to know whether it is indeed feasible to identify self-help innovation districts through such a survey; whether there are any reliable predictor characteristics that can differentiate schools not only as to the general question but as to the types of innovation in which they engage; whether a sufficient number of such districts can be identified so as to make phase 2 viable; and most important, whether the phase 1 findings give any indication of the "self-help" factor as likely to account for a variance in the reception to external R&D products. Similar milestone requirements would exist after elements 1) (initial design) and 5) (phase 2 analysis).

These two aspects, the variable skills required, and the critical milestone requirements lead us to consider staging as a potentially desirable strategy, as follows:

Stage 1. Initial conceptualization and research design could be carried out as part of a loosely defined grants competition. The NIE staff would take responsibility for synthesizing the outcomes in collaboration with a panel of consultants drawn from the several Researchers (or groups) that were chosen from the competition.

Stage 2. An RFP, relatively tightly drawn and based on the initial synthesized conceptualization, would be used to select and fund a single contractor skilled for the phase 1 survey and preliminary data analysis.

Stage 3. After completion of the phase 1 survey and analysis the NIE staff, in conjunction again with the panel from Stage 1 above, would make the determination as to whether to proceed with the study.

Stage 4. If the decision was positive a second RFP would be issued for phase 2 and the continuing analysis. This RFP would be far less tightly drawn--only mandating the use of the phase 1 results in the planning and design. These results would be a part of the RFP as would be the original synthesized conceptualization. The RFP should be open to everyone (possible) and collaborative relations between groups strong in conceptualization and in survey research could be encouraged by indicating in the RFP the importance of creative conceptualization of the issues and by permitting the maximum possible period for response (and informally by NIE letting the field know that this is seen as a desirable aspect).

Stage 5. Using personnel identified in the previous stages as active consultants, NIE sould take responsibility for the development of alternative delivery strategies. RFPs could later be issued for the design and conduct of field experiments and evaluation research (formative and then summative) when this becomes appropriate.

B. Multi-Purpose Strategy

As we have already noted the opportunity for achieving several NIE purposes through this procurement exists.

The manifest purpose of identifying the "self-help" Districts and of learning something of their innovation receptivity behavior has been described. But there are other more latent purposes that could be achieved.

1. System Building

At least two opportunities for system building can be identified.

First, the very targets of the survey, the self-help Districts, could be looked upon as potentially very important members of the educational R/D&I system (as sites for model programs, possibly receptive entry points for R&D products, models of local implementation capacity development, etc.). It might therefore be worth considering the development of a loose network of such Districts--operating much as an invisible college might. Attempts to involve them in programs, even in later stages of the present study, could have positive consequences for the R/D&I system.

Second, we could consider the consequences for the R/D&I system of developing the network of Researchers who might be involved in this study. The effect of creating the original design group and their continued use as a panel of consultants could be very important for the field. Also, the efforts aimed at linking the more conceptual Researchers with the strong field survey organizations for work in this area (as suggested above) could act to add considerable capacity to the educational R/D&I system.

2. Monitoring

The issue of monitoring as a critical requirement for R/D&I system building and orchestration was frequently noted in our general analysis. We have also already touched upon this in our review of this case. While monitoring was not an initial or explicit purpose of the study, it is evident that to make use of its findings (if these turned out to be of value) for the design of future dissemination and development strategies would demand an ongoing monitoring process. Additionally, the type of data that would be collected would provide a basis for the design of a system to monitor the existence and functioning of a potentially very significant phenomenon in the R/D&I system. Hence, in orchestrating the survey design, execution of its phases, etc., NIE should make explicit its desire to have the efforts lend themselves to these monitoring purposes.

3. Environmental Impact

It may be that by paying explicit attention to the value of self-help efforts, and presenting in a positive light NIE's desire to see a synergistic interweaving of internally and externally-generated innovations, that positive consequences could be generated for the Agency and its R&D efforts. These might involve increase in legitimacy ("We do not assume that all wisdom comes to you from the outside") and in the political climate ("We are really seeking to involve quality local capacity").

C. Internal NIE and Other Non-Procurement Behaviors

The central theme of the proposed NIE strategy with respect to this study was that frequently recommended in this analysis--orchestration. The key to the strategy was the careful orchestration of various types of participants so that they could play their optimal roles at the right stages, the building-in of key checkpoints or milestones, the encouragement of desired collaborations, etc. Clearly this would call for NIE personnel capable of performing such tasks, as well as the synthesis of ideas for the study as we recommended after stage 1.

We also noted the need for cooperation and communication across a number of groups within NIE that could (or should) have been interested in the study. Further, NIE might consider with which other agencies (e.g., OE) it should be cooperating in the conduct of this study and in what might grow out of it.

Finally, there may be other (essentially) non-procurement actions that would be seen as contributing to the various purposes of the study. One such example might be the holding of a session at AERA on the topic, or a special conference. There may be others.

6. Likely Impacts

We have suggested throughout this scenario what we believe might be a number of the likely impacts of this alternatively designed procurement. We summarize these here:

a) There would seem to be a strong possibility of highly creative thinking in the survey design stage.

b) Consequently, the long-term data base and monitoring system evolving out of this survey program would likely be appropriately oriented toward: developing increased understanding of the R/D&I system in education; and identifying useful leverage points for policy interventions.

c) Several system-building impacts seem likely: developing communication linkages around the strong Research talent of the relevant Research areas (e.g., "invisible college" mechanisms); providing additional support for, and facilitating the quality work of strong Research organizations working in relevant Research areas; affecting the long-term Research agendas of these strong organizations and increasing the potential for synergy across the work of these various organizations (and between their agendas and NIE's); and possibly over the long run developing linkages among the self-help Districts and strengthening their capabilities as key participants in the R/D&I system.

d) NIE's close working relationship to the field in carrying out this procurement and related activities is likely to strengthen NIE's position vis à vis the field and enhance the Agency's image as an integral and key part of the field facilitating its development.

e) Other positive environmental impacts would also seem likely. SEA and LEA personnel are likely to view with favor NIE initiatives that recognize their innovative potential and accord them respected status as key organizations in the R/D&I system. Given the generally strong influence of education interest groups on Congress and the public, this would seem to suggest important side-benefits for the Institute's image, legitimacy, and long-term stability.

f) NIE's position as the lead agency for Research and Development in education is likely to be strengthened by cross-agency coordination of the kind suggested here. Given the critical interrelationships between OE and NIE programs, it would seem clear that collaborative/coordinating strategies between OE and NIE (as well as other agencies) should have substantial long-term payoff.

g) For NIE, one of the most significant organizational impacts of this alternatively designed procurement may be the promotion of internal communication across NIE divisions, the development of synergy across divisional program lines, and the emergence of a systems perspective across the Agency -- with all that implies for the consideration of interaction/portfolio effects, building multi-purposes (especially system building) into procurements, and designing procurements in relation to a variety of non-procurement actions that in the long run may have greater consequence for the system than any individual procurement or set of procurements.

The procurement as initially conceived might clearly have accomplished much that could be viewed as highly beneficial, and it is not our purpose to find fault with procurements made in this manner. Still, we believe that the benefits likely to accrue from the redesigned procurement are substantially greater. Therefore, we recommend this approach to the Institute and the Council for their consideration.

II. UNSOLICITED PROPOSALS: A PROPOSED FRAMEWORK FOR DESIGN OF NATIONAL PROGRAM EVALUATIONS

1. Description of the Procurement*

Among the unsolicited proposals received by NIE in mid 1976 was one particularly interesting description of a framework for design of national program evaluations. The approach was designed to provide the kinds of process and impact data that could be expected to meet the information needs of decision makers at different levels of government as well as program managers and staff. The approach permitted some degree of local variability in designs and emphases while at the same time enabling data to be aggregated or disaggregated to meet different decision needs. What made the proposal seem particularly intriguing was the comprehensiveness with which program characteristics and implementation conditions were treated in the scheme outlined.

The Research organization that submitted the proposal was requesting funds for elaboration and subsequent testing of the framework across several national programs varying in key program and/or implementation characteristics.

The proposal appeared to be relevant to the program concerns of several NIE divisions and was therefore reviewed by each of these in turn. In some cases, program personnel were not sufficiently interested in the proposal to be willing to fund it out of their own allocations. In one case, there was substantial interest in funding the proposal but available funds of that division for the given program year had already been committed. The leadership of that division suggested that perhaps the needed funds might be secured from the budget of the Director's Office where there was available a small reserve fund for potentially significant funding opportunities of this kind.

The Director's Office requested that the proposal be reviewed by several leading members of the Evaluation Research and Research Design fields.

---

*While the case is presented to read as though it describes an actual NIE procurement, it is in fact hypothetical. Also, the authors imply no position on the substantive content of the procurement.

Favorable comments were received from most of these reviewers, with only minor points suggested here and there for rethinking. These points, along with some additional considerations and possible reservations, raised by a knowledgeable NIE staffer, were then forwarded to the proposing Research organization. After some discussions, a mutually agreeable Research Grant scope of work was drafted, calling for full development of the proposed scheme and field testing of its utility and effectiveness at specified sites of designated federally-funded national educational programs carried out under NIE or OE auspices.

NIE staff had previously met with OE personnel to advise OE of the proposed grant, suggest and work out the details of the needed coordination between agencies, and secure OE approval and cooperation in the use of OE-funded programs and OE-supported program sites in the field test. OE was enthusiastic about the grant since it had been supporting related work on the development of a set of somewhat standardized models for ESEA Title I evaluations. The work supported by OE was similar in its orientation toward making possible data aggregation or disaggregation as needed to meet different information needs. But the OE-supported work was less powerful in its lack of attention to implementation conditions (a weakness recognized by the OE contractor and taken into account in their longer-term plans).

2. Impacts

In considering what the likely impacts of this procurement might be, the following seems reasonable:

a) The work might well produce a significant breakthrough in resolving some of the methodological dilemmas of the Evaluation Research function at this point in its development. Its positive reception from leaders of the field might be viewed as encouraging. However, since breakthroughs tend to be relatively rare and Research of this kind involves a considerable amount of uncertainty, it is also quite possible (and perhaps even more probable) that difficulties encountered along the way will reveal unanticipated problems in the proposed framework, weakening its utility for widescale application. If such is the case, then the substantive Research output might better be classified as an important (or possibly unimportant) part of the accumulating knowledge/technology base of the Evaluation Research function, and not as a key breakthrough in the field's methodological development.

b) NIE's involvement of the field in evaluation of the proposal is likely to be well received, at least by the part of the field included in the evaluation process. Given the NIE strategy of including the field's leadership in this process, the payoff in generating positive field affect is likely to be substantial (unless of course the field is undergoing a period of change or is divided into different "schools of thought" and NIE's selection of advisers takes into account only one of several groups vying for influence on the direction of the field's development).

c) NIE-OE coordination of efforts is likely to strengthen the links between these two key education agencies.

3. Evaluation of the Procurement and its Impacts, Actual and Potential

In evaluating the procurement, Agency personnel must weigh actual (or likely) impacts of a procurement as initially formulated with possible desired impacts. The question to consider here is: How might such a procurement be designed to better achieve Agency purposes, or to achieve a broader range of Agency purposes?

At the very least this question requires insuring some clarity on Agency purposes: What in fact are the Agency purposes that are viewed as relevant to this procurement? Might a somewhat different view of the Agency role and its requirements for procurement policies produce a different or an enlarged picture of the relevant purposes?

At the very least, NIE's role is conceived as that of a funding agency which can facilitate quality work in the field through choices as to which work it funds. Therefore, the unsolicited proposal would likely have been evaluated in accord with some of the criteria we suggested in our discussion of the Research function: Does the proposal fall within a Research area with which we have decided to work? If it does, can the proposal be judged to demonstrate the level of state-of-the-art creativity and Excellence that calls for support. (If it falls outside a Research area that we have decided to work with, but is of such excellent quality that NIE should in some way or other be part of its sponsorship, how might NIE work with other agencies to insure and to coordinate its support?) Does NIE have the kinds of people in-house who can work with the proposing Researcher(s)? Which Researcher(s) and which organization(s) will be supported if the proposal is funded -- a "star" of the field? an exciting new talent? an existing center of excellence with the needed minimum critical mass of relevant talent? or, an institutional setting lacking in the organizational resources needed to adequately carry out the proposal or build long-term system capacity?

Once we start considering this latter group of questions, we have moved considerably beyond a conception of NIE's role as simply a funding agency seeking to identify individual proposals to fund. Instead, NIE's role is viewed in terms of broader, more system-oriented responsibilities.

One of our basic contentions in our discussion of the Research function was that the latent, long-term, system-building potential of any Research procurement was likely to be far more consequential than the manifest substantive purpose of the procurement. If this argument is accepted, and if we define the relevant Research area as Evaluation Research methodology, then several aspects of the Evaluation Research function as it exists in the education sector today become relevant to evaluating the proposed approach to making this procurement:

a) The knowledge/technology base of the field has been undergoing extensive development in recent years.

b) There is a clearly visible Evaluation Research community, with its own leadership, its own channels of communication, its developing standards of quality work, etc.

c) Though the numbers of Evaluation Researchers and institutional bases for Evaluation Research are large, the amount of first-rate talent is somewhat limited and is distributed unevenly across the various types of performer organizations in the field.

d) There is a huge federal investment in Evaluation Research, especially if one aggregates Evaluation Research expenditures across agencies.

e) There is substantial foundation interest (the Russell Sage Foundation) in the development of Evaluation Research methodology.

Therefore, it seems reasonable to consider how much greater the potential impact of this unsolicited proposal might be if it was used as a base on which to build a broader-scale, longer-term, staged, multi-purpose program, coordinated across governmental agencies and internally within NIE across divisions and program boundary lines.

4. Possible Alternatives

A. Work with the Proposing Researcher in an Interactive/Collaborative Mode

If NIE had strong in-house staff with the needed methodological skills (and there would seem to be some staffers with these talents at present), the Agency could work with the proposing Researcher to strengthen the proposal, relate it to other work going on in the field and other relevant initiatives funded by other agencies (e.g., OE). In-house personnel could possibly: facilitate information exchanges between the proposing Researcher and others in the field; develop meeded syntheses and critical reviews mapping the area and the state of the art, useful for stimulating field communication about the proposed framework (and the ongoing work to elaborate and test it); make data available for use in elaborating or testing the framework's utility prior to field work, etc.

B. Using the Proposal as a Basis for Developing Close Working Relation- with the Strong Talent in the Field

NIE might consider convening a continuing seminar or panel to discuss the implications of the proposed (and subsequently the ongoing) work, to assess its quality, and to consider what it does or does not suggest about directions for the methodological development of the field as well as the work's practical applications in national program evaluations. This kind of ongoing seminar might become a wedge for design of alternative approaches (or components of a single unified approach), each carried out by different participants in the seminar, alone or working together collaboratively.

C. Cross-Agency/Funder Coordination

NIE might play a leadership role in contacting other agencies or funders (e.g., the Russell Sage Foundation) to stimulate their interest in this proposal as well as the possibilities of identifying synergistic add-ons or points of relevance to work sponsored by these other funders. Possibilities for pooling of resources might be a particular point of focus in these interactions.

D. Internal NIE

All NIE project officers might be asked to consider their program evaluation needs and how these might relate to the proposed framework. Such discussions -- in-house, with the proposing Researcher, and with the long-term advisory panel of leaders of the Evaluation Research field -- would seem to have the potential to stimulate cross-program communication and synergy in the development and interrelation of Evaluation Research designs for NIE programs.

5. Summary Description of the Alternative Procurement and Related Activities*

A. Staging and Field/Agency Relations

The procurement and related activities could be thought of as having the following possible elements:

1) collaborative/interactive NIE-Researcher development of the proposal in its final form;
2) NIE staff development of state of the art syntheses and critiques that relate the proposed framework to the existing technology base of the field;
3) convening of a long-term, on-going seminar of leaders of the Evaluation Research and Research Design communities to assess the validity, significance, and implications of the ongoing work -- as well as to facilitate the development of an "invisible college" mechanism;

---

*We wish to remind the reader of the hypothetical character of both the process described and our neutral position as to the substantive content.

4) design of alternative models, or system components of a unified model, with different members of the seminar group working on pieces of this, individually or collaboratively;
5) testing of the initially proposed framework (as elaborated), and possibly alternative models, through reanalysis of available Evaluation Research data sets;
6) field testing of these frameworks/models in a small sample of selected program sites;
7) large-scale field testing across varying programs nationwide;
8) consideration of utility of developed models at interim points in the testing procedure;
9) convening conferences of Evaluation Researchers and program personnel from varying national educational programs to consider the implications of this work.

Several of these stages might be clustered together, but what is important is that each stage suggests critical questions that will need answers before it will be obvious as to whether it is justifiable to proceed.

B. Multi-Purposes

The manifest purpose of this procurement -- i.e., to elaborate and test the proposed framework -- appears to be of some consequence in and of itself. But in addition, other latent purposes could be achieved as well if the procurement was considered in system-oriented terms. We have noted several ways in which system-building purposes could be achieved (e.g., facilitating communication among, and providing additional support for the work of, the strong Research talent and Research organizations in the field). In addition, positive environmental impact might accrue from involvement of the program personnel in the assessment of the new framework and its implications after the field test results are available for consideration.

6. Likely Impacts

a) NIE's close working relationship to the field in evaluating and then expanding the scope of this proposal is likely to strengthen NIE's position vis à vis the field and enhance the Agency's image as an integral and key part of the field facilitating its development.

b) As we have noted, several system-building impacts seem likely: developing communication linkages among the strong talent in the Evaluation Research and Research Design fields (e.g., "invisible college" mechanisms); providing additional support for and facilitating the quality work of strong Research organizations working in relevant Research areas; and affecting the long-term Research agendas of these strong organizations and increasing the potential for synergy across the work of these various organizations (and between their agendas and NIE's).

c) NIE's position as the lead agency for Research and Development in education is likely to be strengthened by cross-agency coordination of the kind suggested here.

d) Increased communication among NIE program officers (considering the implications of this proposal to their programs) is likely to strengthen the development of stronger program evaluations that consider interaction effects across programs as well as impacts attributable to discrete programs.

Our conclusion here is similar to our statement in the previous scenario. The procurement as initially conceived might clearly have accomplished much that could be viewed as highly beneficial. And, clearly, much that we have suggested is similar to courses of action frequently followed by the Institute. What may be different here, and what may explain any additional benefits likely to accrue from the expanded description of the rethought procurement and non-procurement actions, is the emphasis on simultaneity and interaction among these occasionally considered options. We therefore recommend this kind of thinking to the Institute and the Council for consideration.

CHAPTER TWO

ASSESSMENT OF EDUCATIONAL R/D&I

December 1976

CISST Project Team:

Michael Radnor
Durward Hofler
Harriet Spivak

CONTENTS

Page

I. FRAMEWORK: A SYSTEMS VIEW OF EDUCATIONAL R/D&I 1

- 1. Developing an Analytical Framework for a New Field 1
- 2. Educational R/D&I as a System 1
- 3. Stages of Development 2
- 4. An Expanding View of Educational R/D&I 3

II. ASSESSMENT OF THE DEVELOPMENT OF SYSTEM CAPABILITY OVER THE DECADES 4

- 1. The Bases for Assessment of the Educational R/D&I System 4
- 2. The Historical Context 4
- 3. The Institutional Base 5
- 4. Personal Base 8
- 5. Outputs 10
- 6. Linkages to Educational Practice 12
- 7. Funding 13
- 8. Knowledge/Technology Base 15
- 9. Development of R/D&I Management and Policy Know-How 17

III. STATUS AND NEEDS OF MAJOR R/D&I FUNCTIONS 17

- 1. Basic Research 17
  - A. Assessment Basis 17
  - B. Current Status and Expectations 19
  - C. Key Needs 20
- 2. Problem-Focused Research 20
  - A. Assessment Basis 20
  - B. Current Status and Expectations 22
  - C. Key Needs 24
- 3. Development 25
  - A. Assessment Basis 25
  - B. Current Status and Expectations 27
  - C. Key Needs 29

CONTENTS (Continued)

Page

4. Dissemination 29
   A. Assessment Basis 29
   B. Current Status and Expectations 30
5. Evaluation Research 32
   A. Assessment Basis 32
   B. Current Status and Expectations 33
   C. Key Needs 34

CONCLUSION. 35

I. FRAMEWORK: A SYSTEMS VIEW OF EDUCATIONAL R/D&I

1. Developing an Analytical Framework for a New Field

Institutionalized Research, Development and Innovation (R/D&I) in education is little more than a decade old -- yet the R/D&I system capacity (as we can assess it now), our understanding of the system and our ability to manage it have increased significantly.

We are now in a position to begin to develop and refine, over the next few years, an analytical framework and a relatively unobtrusive monitoring system (for data gathering) with which we may assess the educational R/D&I system in terms both of progress made to date and of what might reasonably be expected in the near term and longer term future. Such an assessment would provide the basis for annual or periodic reviews of the educational R/D&I system.

The analytical framework and the monitoring system for such assessment could be developed from our growing knowledge of R/D&I in other sectors and of the conditions pertinent to the education sector in particular.

In this brief overview report, we will suggest in broad terms what such a framework might look like; what should be the basis for assessment in the current and succeeding periods; in these terms, but based on the incomplete and tentative evidence and impressionistic judgements available at this time, what is the status of key elements in the system and what can be expected in the near and longer terms; and finally what major needs require consideration in formulating federal policy and program initiatives.

2. Educational R/D&I as a System

It is important to make explicit a key premise that underlies the proposed framework; namely that the institutions and personnel involved in the production and utilization of educational R/D&I outputs form a "system" and not just an unconnected "configuration" of entities. Acceptance of this premise does not deny that there can be and often is only a weak linkage or integration between institutions which should be more closely related and whose goals might show more coherence. Nor do we imply any monolithic, centralized network. But there are very significant implications for long-term planning and monitoring and for the development of initiatives by a federal agency that do come from such a "system" perspective; i.e., of a leadership that can give meaning to an expansion and maturation of educational R/D&I capacity.

Most particularly, the perspective permits a proper concern for capacity building and system maturation. It also permits a recognition of those fundamental or generic characteristics common to all R/D&I systems and allows us to learn from their difficult experiences in growing to maturity. An informed policy perspective for educational R/D&I must be based on an understanding both of these generic issues and of the special characteristics of of the educational context.

3. Stages of Development

R/D&I systems characteristically go through various stages of growth and development -- from the uncertainties and insecurity of birth and early years; to a period of striving to establish themselves and their legitimacy; to a more mature period in which their functions, institutions and linkages are well established.

In the early stages, one finds unrealistically high expectations and over optimistic forecasts concerning high quality results - to be delivered quickly and implemented on a widespread basis. Since in reality the development of an R/D&I system (and its outputs) takes much longer and requires much more investment than is usually recognized at the time, one soon also finds frustration and a tendency to "overreact" on the part of R/D&I system personnel, funders and sponsors.

Thus, it becomes important to assess the value of investments to date in terms of whether or not a strong basis for the future and future returns has been developed -- not in terms of sunk costs, disappointments and unrealistic early expectations.

4. An Expanding View of Educational R/D&I

Over the past two decades, federal funding policies have reflected an increasingly broadening perspective of what constitutes an educational R/D&I system. Initially, funding was channelled primarily to Research; then increasingly to Development (e.g.: design and development of curriculum, instructional packages, etc.); to Evaluation Research in the 1960's; and, more recently, increasingly to Policy Research.

Most recently, there has been a dramatic increase in funding support for functions which link R&D outputs with utilization in school systems -- i.e., the Dissemination function and assistance for the Implementation/Utilization functions. Indeed, support for Utilization activities represents 43% of educational R/D&I funding in both FY75 and FY77 (projected).

In addition to a broadening perspective as to which R/D&I functions to support (as noted above), there has developed an expanded view of (1) the institutions in which various R/D&I functions are performed (thus, for example , we find substantial federal funds being channelled to User system institutions to develop User system capacity for innovation); and (2) the type of institutions with which NIE may establish special relationships (e.g.,with academic and private sector institutions as well as with the federally created labs and centers).

II. ASSESSMENT OF THE DEVELOPMENT OF SYSTEM CAPABILITY OVER THE DECADES

1. The Bases for Assessment of the Educational R/D&I System

An effectively functioning mature R/D&I system must have:

1) a network of stable institutions of minimum critical mass, properly attuned to their various functions (Research, Development, Dissemination, etc.), and appropriately linked to each other and to Users;
2) qualified personnel in sufficient numbers, properly distributed and focused on appropriate programs;
3) visibility and legitimacy among the various R/D&I system stakeholders;
4) adequate and stable levels of funding;
5) a strong knowledge and technology base;
6) system managers, decision makers, policy makers who have relevant management and policy training and skills.

Only when these conditions exist can one expect the R/D&I system to have the capacity to provide a meaningful flow of high quality outputs (which could improve educational practice) that are adopted and used effectively by a significant number of Users.

The current state of the educational R/D&I system's capacity and quality of activity may be assessed, but the assessment must also involve:

1) a comparison with the state of Educational R/D&I in the past, and
2) the potential for future R/D&I system development and maturation.

2. The Historical Context

The challenge that has faced us over the past two decades has been one of virtually creating an educational R/D&I system de nova. R&D work did exist -- but not a cohesive R/D&I system properly linked to Users.

Specifically, two decades ago one would generally find:

1) scattered researchers (mostly individuals or small teams in academic settings studying schools and students, nonetheless having few strong linkages to User system personnel);

2) a small number of large curriculum improvement projects in selected subject areas (again, staffed largely by university scholars);

3) a considerable amount of in-house, practice-based development of curriculum (by school system personnel);

4) private companies providing textbooks, materials and equipment -- and a very few small Research corporations.

None of these tended to have significant discernible impact on the User system or on the accumulation of a knowledge or technology base directly applicable to the solution of User system needs and problems. This is not surprising when we consider that R/D&I generally lacked:

1) strong linkages between Researchers, Developers, Producers, Disseminators and Users -- or even among personnel within a specific functional area (e.g.: among Researchers);

2) significant leadership or coordination either from the field or from any national level organization.

3. The Institutional Base

We can identify some significant changes over the past two decades in the institutional base of the educational R/D&I system. For one thing, the mission oriented organized R/D&I mode has replaced the individual/small team mode as the dominant mode of R&D. For another, there are now some 1500-3000 R/D&I organizations (precise figures by functional/organizational category must await survey work now in progress). These include (at the very least):

1) the various educational organizations created through federal initiative and funding (e.g.: the regional laboratories, R&D centers, ERIC clearinghouses,materials centers, etc.),

2) R&D capacity in several hundred academic and private sector Research or R&D institutions/organizational units (including private publishers, equipment companies, etc.);

3) R/D&I capacity (mostly newly created) in every SEA, in ISAs and even in several hundred of the larger LEAs.

Most of this capacity is relatively new (even on the SEA/ISA/LEA levels), having been created or expanded with federal funding.

The impact that federal funding/procurement policy can have on an R/D&I system is well illustrated by the dramatic development of the private sector noted above (which has been receiving a quite substantial percentage of the federal educational R/D&I dollar) -- compared to (and at the expense of) the academic sector (which in recent years has received a relatively small percentage -- in marked contrast to earlier years). To illustrate, in FY 1971, only 21% of DHEW evaluation awards were to the academic sector, while 74% went to the private sector (29% to non-profit and 45% to for-profit corporations) -- this despite evidence from at least one study suggesting that evaluations done by the academic sector have tended (on the whole) to be substantially superior to evaluations done by the private sector.

Another point to note is that a small number of institutions -- fewer than 50 -- are receiving the bulk of NIE R/D&I funding. Does this mean that these fewer than 50 essentially represent the extent of the R/D&I system's high quality institutional base? Or are there other high quality institutions which (for whatever reason) have not found NIE funding activities attractive? And if so, how many? We currently have no data with which to answer these questions, though preparatory work is already underway at NIE for a future set of studies to analyze distribution of institutional capability in relation to various kinds of R/D&I activities.

A third point to note is that there has been some significant instability within this expanding R/D&I institutional base. Institutions or new organizational units have emerged -- only to disappear a few years later for lack of funding or markets for their services. Only 7 of the original 20 regional laboratories remain today, and only 12 of the 15-21 centers.* However, we must also note, (admittedly impressionistic) evidence suggests that: (1) the expansion rate has been significantly greater than the contraction; and (2) there appears to have been some degree of "leveling off" of the "shakeout" of existing R/D&I institutions (as seen, e.g., in the strengthened political position of the labs and centers). We would also note that this observed historical pattern with the R/D&I system institutional base is precisely what one would expect in introductory and late introductory stages of an R/D&I system's development -- i.e., a substantial degree of institutionalization has occurred (with some losses), and a healthier degree of career stability has become possible within even the newer of these institutions. Given the predominant federal role in funding educational R/D&I activity, future decisions about the level, direction, and form of funding to these institutions (which we know to be very responsive to such funding patterns) will be determining as to their future.

---

*The types of organizations included under the "center" rubric varies in different discussions.

4. Personal Base

Although we generally lack precise data about the educational R/D&I system's personnel base, the following general estimates and analyses can be made:

1) In comparison to the mid-'60s, the educational R/D&I personnel base has doubled (perhaps tripled). The best estimate was that the R/D&I system personnel base in 1969 totalled about 4,000 persons. In 1974, several estimates suggest a mean figure of about 10,000 persons (estimates ranged from 8-12,000, and higher or lower estimates can be found, depending on one's definition of an educational R/D&I system).

2) Most of that work force is represented by Researchers and by Development personnel.

3) There would appear to be a particularly inadequate number of personnel to carry out linkage roles in Dissemination/Feed Forward and support roles for Need Identification, Implementation/Utilization -- especially if these functions are expanded over the next few years to the degree suggested by various programs now in the planning or discussion stages.

4) Most educational R/D&I personnel have an educational or psychology training background (roughly 90% in 1965 and 80% in 1974) and university or school system work backgrounds. Given the interdisciplinary nature of educa-

tional R/D&I personnel base. In this respect, the above figures represent limited progress, but perhaps less than one might have expected.

When the current survey of R/D&I organizations is completed and the personnel data are analyzed, we will have a relatively good basis for determining the precise size of the personnel base, how it is distributed by work setting, functional specialties, and representation of minorities and women.

Precise data on the participation of women and minorities in the educational R/D&I work force must await the results of the current organizational survey of R/D&I performers. (Based on such indicators as AERA membership, it would now appear that neither women nor minorities -- except Orientals -- are present in the personnel base in proportion to their numbers in the population -- though the level of participation of women is significant -- 28% of AERA membership.)

Until additional contemplated special studies of the personnel base are undertaken, we will lack the needed data we need to understand the sources of that work force (by background, training, career history) or the incentives, expectations, and aspirations likely to affect the success of policy initiatives to expand that base, affect its diversity, recruit personnel for new system roles, or stimulate consideration of mid-career shifts in patterns of functioning.

Educational R/D&I planners have raised serious concerns about imbalances and weaknesses in the system's personnel base; e.g.:

1. an inadequate number of specially trained personnel in the User-oriented functions (dissemination, Implementation/Utilization);
2. limited availability of strong training programs specifically designed for functional specialties (except for Basic Research);
3. a far too limited number of first-rate talent being attracted to the field.

None of the corrective strategies attempted over the past decade have been wholly satisfactory. As a case in point, the substantial support received for Research training programs in the '60s seems to have contributed substantially to the training (and probably to some extent to the recruitment) of about 1,000 current educational R/D&I personnel. However, it is not entirely clear that the training provided in these somewhat conventional Research training programs was the kind of training needed to meet the needs of R/D&I functioning, and the large scale, high priority, federally-funded programs have been discontinued. Although some subsequent training programs have received federal support (e.g.: new programs to train change agents and other linkage personnel), the scale and level of funding of current programs would not be adequate for either rapid expansion of the system's personnel base or near-term correction of the imbalances in the current personnel base across functional specialties.

Our knowledge of other R/D&I systems suggests that:

1.) The rate at which the personnel base can be expanded varies among R/D&I system functions.
2.) In Research (and to a lesser extent, Development), the rate is dependent on the number and size of the existing centers of excellence (which alone can provide the training) and is a long term process.
3.) For the linkage functions (Dissemination and to a lesser extent Development), training programs can be developed at relatively modest levels of funding and personnel trained within a relatively short time frame. However, training in these functions will be constrained by (1) rates and levels at which Users can reasonably absorb their outputs and (2) the relative lack of codification in the knowledge/technology bases.
4.) Thus, merely investing dollars in training is not always wise or effective.

5. Outputs

Educational R/D&I activity has produced a substantial number of outputs over the past decade or two. Some 776 of a much larger number of practice-oriented outputs developed with OE or NIE funding over the past decade are listed in the 1976 Catalog of NIE-Sponsored Educational Products. Clearly, a listing of the total number of outputs during the past two decades which have been produced by all institutions within the R/D&I system from all funding sources would be many times larger.

At this time, there are few data-based statements that can be made about overall quantity or quality of these outputs. There has been considerable criticism phrased in rather general terms about the poor quality of educational R/D&I outputs, but this tends to be impressionistic or based on examination of a relatively small proportion of what has been produced.

At the same time, the system has always produced at least a few outputs of outstanding quality and widely reputed excellence -- the NSF science curriculum improvement projects of the late '50s and early '60s (PSSC, CHEM, BSCS, the School Math Study Group); Individually Prescribed Instruction; Sesame Street; etc.. In an effort to identify and make better known some of the other high quality outputs of the system, projects to identify exemplary products of R&D efforts have brought increased attention to at least 30 such outputs. Examples of a few of these products with extensive utilization histories are:

- Sullivan Reading Program (programmed readers), reportedly being used by more than 5 million children
- Science Curriculum Improvement Study (fundamental concepts/elementary school science), reported to have been used by more than 1 million students
- Science -- A Process Approach (elementary school science taught through processes of observing, measuring, classifying, predicting and inferring), estimated to be used to teach millions of students
- Kindergarten Program, or First Year Communication Skills Program (basic skills of English language communication), used by about 250,000 students
- Man: A Course of Study (social science curriculum for grades 5-7), reported to have been used by at least 200,000 students

SEAs (with an additional impetus from federal support) have been identifying, packaging and disseminating potentially high quality "exemplary practices" developed by local school personnel for their own use. As yet, it is too early to judge whether the exemplary practice concept will be a major source of innovation for the educational system or an illusory will o' the wisp, more hopeful than practical or workable in reality -- as one of its critics charge.

There has also been an attempt to provide comparative evaluative information about alternative products, practices and packages to meet given needs. Again, it will take some time before we will be in a position to assess the quality or utility of these outputs.

6. Linkages to Educational Practice

Clearly, whatever might be said about the quantity or quality, effectiveness or utilization of outputs of the educational R/D&I system over the past two decades, it would be fruitless to contend that the investment in the educational R/D&I system to date has produced substantial, widespread impact on educational practice. There have been some clearly outstanding outputs produced by the system that have been well received and have reasonably extensive utilization histories. Some firm linkages have appeared between some of the stronger Development organizations (e.g.: some of the labs, centers, and private sector firms) and the school systems who have been using their products. On the whole, however, there has been rather minimal integration between R&D, on the one hand, and educational practice, on the other. Neither the findings of educational Research nor the products of specialized R&D organizations or the highly publicized innovative strategies of recent decades have generally been found to have any discernible impact on educational practice; where they have been found, they tended more often than not to be emasculated into "more of the same old thing."

School systems that are highly innovative have been described as using local resources to develop innovations designed only for local consumption. Consequently, a vast body of practice-based innovation fails to get documented or disseminated.

Innovation in education, then, where it does exist, is not being managed with maximal efficiency for widespread impact on the educational enterprise in this country. But clearly, the picture described above is what one would expect to find for a relatively young R/D&I system in the early stages of its development -- i.e., sporadic examples of significant, impactful knowledge production/knowledge utilization linkages amid a general picture of much less substantial achievement.

One of the most promising trends in recent years has been the increased attention given by funders and policy makers to the development of effective linkage mechanisms. For example: the substantial share of federal R&D funding allocated to Dissemination, Implementation, and Utilization activities (43% of federal educational R/D&I funding in FY 1975); the increasing flow of federal R/D&I funding to User system institutions (SEAs, ISAs, LEAs); new types of R/D&I activity being supported with federal funding (e.g.: State Dissemination Capacity Building Grants and LEA local problem-solving projects and capacity building accompanied by documentation and analysis of the processes used so that they can be packaged and disseminated to other LEAs); etc.

Precisely how much linkage capacity now exists in place, how it is distributed, and how adequately the various existing mechanisms link Producers and Users are questions we cannot yet answer on the basis of existing data or even data surveys now being planned. More specialized studies of Producers, Users, and linkers will be needed.

7. Funding

In FY 1975, total funding for educational R/D&I in this country, from all sources, fell somewhere between $504 million and $665 million (depending on what is included or excluded in a given estimate), with

$576 million the most likely figure. Of this total sum, approximately 82%, i.e., $470 million (with a possible lower bound of $430 million and a possible upper bound of $520 million), came from various federal departments or agencies. The remaining sources of educational R/D&I funding include: State funds, $40 million ($30 million to $60 million); local government funds, $4 million ($2 million to $10 million); private foundations, $57 million ($57 million to $65 million); and other private sector sources, possibly (but here estimation is especially difficult) $5 million ($3 million to $25 million).

By comparison, the level of funding estimated to have been invested in educational R/D&I by all sources in FY 1968 was $250 million. Data for the previous decade or so are less adequate, but some idea of the magnitude of the increase in funding levels can be seen in data from USOE, the largest single source of funds for educational R/D&I activities: USOE appropriations for research and training rose from $1 million in 1957 to a little over $100 million in 1969. The level of funding available from federal sources has levelled off somewhat since 1966 (in terms of rate of growth) when the period of the most rapid expansion of the system's funding base ended.

Federal funding for educational R/D&I activity is provided by a substantial number of federal departments and agencies. Different data sources vary in the way they define relevant R/D&I activity and the departments and agencies from whom budget data are collected. The best recent set of data, gathered by a National Academy of Sciences study group, provides data figures from 21 departments and agencies (counting four HEW units separately). Fourteen of these departments and agencies provided $458 million of the estimated $470 million or so estimated to have been invested by the federal government in educational R/D&I in FY 1975. The largest source of funding came from the Education Division of HEW ($335 million or 73%): of this $335 million, $294 million came from the Office of Education, $74 million from the National Institute of Education. Substantial sums also came from the Department of Agriculture ($56 million), the National Science Foundation ($40 million), and the National Institutes of Health ($38 million). Quite a large number of other federal agencies provided smaller amounts of funding.

After the current survey of educational R&D performer organizations is completed, we will be in a better position than now to estimate the relative size of funding allocations by functional areas of R/D&I activity, and to determine to what extent the available resources are apportioned in a manner so as to provide the appropriate balance between functions (taking into account the overall stage of development of the R/D&I system and any necessary corrective actions that may be needed to redress previously out of balance conditions).

The NAS data provide useful information about how federal funding for educational R/D&I is divided among groupings of functional areas. The FY 1975 data indicate that knowledge production (research, evaluation, and statistical activities) have received the smallest share of federal funds (17%), while 40% was allocated to applications formulations (materials development, policy formulation, demonstrations, and social experiments). and 43% to Utilization activities (dissemination and implementation activities). Comparison with FY 1977 budget data indicates that knowledge production is receiving somewhat more attention (23%, up from 17%), while application formulations are receiving less (34%, down from 40%) and support for Utilization activities has remained stable (at 43%).

Comparison of 1975 and 1977 budget figures suggest at least one area of concern: when the rate of inflation is taken into account the federal allocations suggest a 14% decline in real terms financial resources available to educational R/D&I.

8. Knowledge/Technology Base

There are two kinds of knowledge relevant to the building of the educational R/D&I system: (1) substantive knowledge/technology relevant to specific system functions (needed by functional specialists) and (2) knowledge about operative aspects of the system: what exists, what policies/strategies do or do not work (needed by system managers and policy makers).

In the educational R/D&I system, the knowledge/technology base is weak in both respects -- probably substantially weaker than for most other existing R/D&I systems. This is understandable: the educational R/D&I system is relatively new; it exists in an emotional, value-laden, political context; and it is multi-disciplinary; it has had a relatively low level of funding.

Nonetheless, so long as the system's knowledge/technology base remains weak, we will tend to find poor quality outputs, which will (in turn) tend to (1) produce and/or reinforce a negative environmental climate for the system, and (2) inhibit the flow of funds, personnel and other inputs into the R/D&I system -- inputs needed for system maturation.

Given the above understanding of these overall weaknesses, we must also take note that relatively substantial progress has been made in the past ten to twenty years -- and that there are hopeful signs for the next decade. To illustrate, one of the most useful (though admittedly "rough") indicators of the state of development of the knowledge/technology base needed by functional specialists is the availability of handbooks and other syntheses of the relevant information -- i.e., some degree of maturation must exist before these can begin to appear.

Using this criterion, we find that educational Research and Evaluation Research have the beginnings of a modest knowledge/technology base, while Dissemination and Development remain relatively weak.

Additionally, there have been efforts to develop knowledge of the operational aspects of the system (e.g.: NIE's R&D System Support Program).

Thus, there are signs that the system's knowledge/technology base will improve in the years ahead. However, we must be aware that this involves a slow, system building process -- it is not done easily, nor will it be done overnight.

9. Development of R/D&I Management and Policy Know-How

As is typical of any newly developing R/D&I system, concerns for management and policy making processes have taken a low priority as compared to programmatic concerns. The dilemma is classical. Those who are most likely to initiate an innovative thrust are least likely to see the need for or pay attention to effective performance in the "mundane" problems of institutional management and the "dirty" problems of policy making. This has been the situation in educational R/D&I. Little attention was given in the past to such issues at the practitioner level or at the Agency level. R&D management for education was not seen as a major and necessary aspect of the agenda of federal funding programs. In the one study that inquired into this question personnel involved in educational R&D management practice indicated that they saw no need for training and upgrading in R&D management skills.

With increasing maturation, again as is typical, concerns in these areas have begun to appear. Problems of organizational design, personnel management, project and portfolio selection, control and evaluation, cash flow management, information management, etc. have begun to plague managers and policy makers. NIE has begun on a modest scale to support some studies of management and policy making processes in R/D&I. The time would thus seem ripe for a major expansion in research and training programs devoted to upgrading the quality of management and policy making processes.

III. STATUS AND NEEDS OF MAJOR R/D&I FUNCTIONS

1. Basic Research

A. Assessment Basis

Basic Research is an uncertain, unpredictable and highly creative undertaking. It is very sensitive to threats to its climate and to the quality and stability of support and funding. It is highly dependent on its roots in its fundamental disciplines. Its outputs are knowledge and stimulation and it is only generally in the long term that we can assess its practical contribution. And, given its inherent uncertainties it becomes hazardous to attempt to predict the areas in which such outcomes will occur. But without it the well of the new thinking frequently runs dry. It is therefore vital that a healthy and mature R/D&I system will have developed and maintained a substantial high quality Basic Research component. But such a component cannot be built quickly. The rate at which quality Basic Research can be expanded is limited by the size and quality of its existing centers of excellence. To pump more funding into this endeavor than such centers can usefully absorb can only lead to waste and disappointment. Future growth is (and will be) limited by past investments in creating and supporting a central core of Basic Research having many centers of excellence of minimum critical mass and larger. The major problem in educational Basic Research has been in the very weakness of this central core.

Assessment of the Basic Research function will need to be based on:

1) The size and quality (based on the reputation of institutions and personnel) of the central core of the Basic Research function -- most specifically on the size, growth and stability patterns of identified centers of excellence. An important indicator will be the ability to attract and hold top flight researchers.
2) The number of new centers of excellence seeded and taking root over successive (rolling) 3-5 year periods.
3) A measure of the supportiveness of the climate - in terms of funding growth and stability over several year periods. Measures of the quality of the linkage to and reputation of Basic Research in education and its more fundamental root disciplines (e.g.: psychology, sociology, etc.).

Over long (10-20 year) time spans, an assessment of major substantive contributions to knowledge coming from educational Basic Research.

B. Current Status and Expectations

Basic Research in education is generally to be found in two types of settings. That located in schools of education (frequently in such disciplines as Educational Psychology and Sociology) boasts few centers of excellence and much mediocrity. A different picture emerges from viewing the research carried on in discipline based university departments such as Psychology and Sociology. Excellence and valuable contributions to knowledge are to be found, but what has been lacking here has been a primary and continuous commitment to education. The interdisciplinary character of educational Research has added to the diffuseness by making communications and information retrieval (from the large variety of publication sources) very difficult. Altogether, this has added up to an educational Basic Research community that has been to date unstable and amorphous. It makes system building in this area a major requirement for NIE efforts and a critical consideration in funding programs.

At the same time, the general climate for Basic Research in education as for other (especially social) areas of Basic Research has been far from supportive. This negative climate has been particularly intense for education which has been hard put to point to more than a handful or significant developments that are traceable to Basic Research. The low prestige with the general public and with Congress and the associated unreliable funding have made it hard to attract strong talent and this has acted as a major constraint on building the central core. As regards funding, it is vital to note that NIE has been a relatively minor contributor to the total funding going to Basic

Research, especially in comparison with such an agency as NIH. Thus, for example, in FY 1975 in the area of early childhood and adolescent education 5% of total federal funding for Basic Research came from NIE while 78% came from PHS/NIH.

C. Key Needs

The key need for the educational Basic Research function is a consistent, continuous, stable process of system building. This would include:

1. identifying existing centers of excellence;
2. facilitating the establishment of additional centers of excellence;
3. facilitating the growth of these centers, existing and new;
4. facilitating improved information exchange and retrieval mechanisms;
5. providing stable, long term funding.

2. Problem-Focused Research

A. Assessment Basis

It is important to keep in mind that Problem-Focused Research _is_ Research and shares with Basic Research a high level of uncertainty and unpredictability. Thus, Researchers in particular treat Problem-Focused Research in a Basic Research _mode_. But it is also _targeted_ Research. Thus, Funders and Users often assume it to have the level of certainty and shortness of time line more appropriately associated with Development. This deceptiveness and the consequent inherent tension makes Problem-Focused Research subject to considerable instability, misdirection and mismanagement, and consequent misdirected assessment.

Researchers frequently redefine and bend Problem-Focused Research into Basic Research modes. In particular, they often attempt to undertake projects on smaller scales than are required by the nature of the problems, which often require the efforts of large-scale interdisciplinary and empirically based team programs. This syndrome is often combined with attempts to oversell the timing, probability and impact of outcomes in order to obtain funding. This often succeeds with funders simply because Problem-Focused Research projects do appear to have practical, attainable outcomes. All of this creates an environment that tends to be unattractive to many of the best Researchers.

On the other side, Users and Funders, having been persuaded to fund such programs because of these very expectations of near-time benefits, become frustrated by not only the lack of delivery but also by the shifting targets, time and cost patterns which are inherent in the uncertain Research process.

Another important dimension of this tension lies in the problem of Need Identification. On the one hand, the objective is to work on important and timely problems that require solution, and this tends to be the prime inducement for the Users and Funders. On the other hand, a Researcher is required to maintain the criteria of researchability -- criteria that often significantly limit the utility of the project from the User perspective. This as well as the previously mentioned problems of tension become magnified when one recognizes that the cost and scale of Problem-Focused Research tend to run orders of magnitude higher than what is typical of Basic Research.

Assessment must therefore be based on judgements of:

1) The quality and appropriateness of the institutions performing this function:

    Are they capable of mounting the required large scale interdisciplinary efforts?

361

Are they attracting and keeping top quality applied researchers?
Are their programs and projects considered to be of high quality, important to practice and on truly researchable problems?

2) Whether Problem Focused Research is emerging as a definable entity, differentiated from Basic Research and Development.
3) After a time lag that reflects several years of sustained system building, an evaluation of the rate and impact of outputs.
4) The climate for Problem-Focused Research in terms of both support patterns and receptivity to its outputs.

B. Current Status and Expectations

Most of the Research that is carried on in education appears to be what might loosely be defined as the Problem-Focused type, much of it unfunded and small-scale. The volume of studies produced may indeed be large -- but being of this small-scale, scattered and fragmented quality, these have been subject to many questions of quality. It is evident that there is substantial lack of differentiation in education between what can truly be classified as Research and various other activities (e.g.: demonstration projects, social bookkeeping, etc.); great weakness in defining researchable problems; considerable fuzziness in differentiating Problem-Focused Research from Basic Research and Development; and the previously mentioned tendency to oversell such projects.

Problem-Focused Research in education is largely carried on in two types of institutional settings: universities and large-scale R&D institutions in the private and quasi-public sectors.

Where this work has gone on in universities, there has been a tendency to perform Problem-Focused Research in a Basic Research mode. This is not surprising given the socialization and prior training of university Researchers and the social and publication pressures under which they operate. Generally, universities find it difficult to assemble the minimum critical mass of effort needed to undertake large-scale Problem-Focused Research projects. As a consequence, they have tended to scale such projects down and/or to assemble ad hoc teams that lack long-range stability. With this has come the unfortunate tendency for Researchers to move in and out of this part of the field which has mitigated against system-building requirements.

Large scale R&D organizations should have been, and to some degree have been, more suitable sites for such programs. However, two important problems have limited their potential success. Firstly, most of these R&D organizations have not been able to promise a stable career path to Researchers, thereby greatly limiting their ability to attract and hold first-rate Researchers. Secondly, federal funding practices in the late '60s shifted the character of many of these institutions away from Problem-Focused Research and reshaped them into Development organizations in accordance with federal priorities at that time for product-centered impact strategies.

As a consequence of the above conditions, education has in fact seen very little Problem-Focused Research. Therefore, this has to be seen as an area that needs to be put together at this time in its own terms and not be thought of as a form of advanced Development or downstream Basic Research.

A number of other problems in educational Problem-Focused Research deserve mention. The climate for such Research has been perhaps even more negative than that described above for Basic Research. This has been so precisely because it seemed to hold out more promise of impact and raised expectations than could have been satisfied -- given the inherent time frame and the weak state of the area. Relatedly, Need Identification, which had been Researcher-driven up through the mid-'60s, became system-driven by Users and Funders in an overreaction to this state of affairs. As with Basic Research, funding has been relatively limited, receiving under 5 per cent of total federal FY 1975 funding for R&D in early childhood and adolescent education. It is interesting to note that NIE's role (at least recently) has been a more significant factor in funding Problem-Focused Research than was the case we observed with respect to Basic Research. (In FY 1975, of all the federal R&D funding in the applied Research category in early childhood and adolescent education, 45% was from NIE alone.)

C. Key Needs

Problem-Focused Research in education, then, must be seen in a system-building mode.

1. It will be essential to locate those centers of excellence capable of performing large-scale Problem-Focused Research.
2. Such institutions will need to be provided with the kind of long-term stable funding that will permit them to attract and retain top-flight staffs of Researchers.
3. It will also be vital for the lead educational funding agencies to help practitioners and the Congress understand the nature and requirements of Problem-Focused Research; to understand that project selection requires the determination of what is researchable as well as what is important; to recognize that the present lack of capacity demands a period of institution-building before

the promise of the area can begin to be fulfilled; and that such institution-building will require an ongoing and long-term commitment.

3. Development

A. Assessment Basis

Critical in the assessment of the Development component of an R/D&I system is the recognition of the centrality of its linkages to the User, to Production and to the state of art in Development. Development has a relatively more predictable and shorter time horizon process as compared to the Research functions. It aims to convert knowledge into User ready products, products which may (or may not) need to pass through a distinct Production phase before they can be disseminated or distributed. With the linkage to the User being so critical, so is the requirement for Need Identification -- a step that is difficult to perform, but one that must be done well and often in an ongoing manner during the Development process (where complete identification is not feasible -- as in many areas of social development) if the product selected for development is to be on target.

Development is also highly dependent on the quality of its linkage to the state of the art and on the skills and motivation with which products are designed so as to be capable of production and dissemination. This determines the effectiveness and viability of the product. It depends on the quality and appropriateness to the task of the institutions involved and the knowledge base upon which they must depend.

Since Development is frequently carried out in specialized Development organizations it is highly dependent on the quality of such institutions and their personnel and most particularly on their experience. It is important to differentiate the concept of excellence in Development from that used in Research. In Development excellence is measured by being cost/effective, timely and opportunistic. With such criteria, experience (individual and organizational) and thoroughness (ability to to the whole job) are often more important than brilliance. Where Development is carried out in a User setting, then assessment must be concerned with the extent of wider dissemination.

Thus, the critical bases for assessment are:

1) quality of linkages to:
    - Users
    - Production
    - Development state of the art.

    Measures of such linkages are hard to define and obtain, depending as they do upon quality, frequency and form of interaction. They will likely be qualitative in nature, and "observable" more in their absence in terms of problems generated, than in their presence.

    A specific manifestation of this linkage will be in the quality of Need Identification, to be measured indirectly by the relevance of Development outputs for practice, and by the scope and effectiveness of feed forward activity from Users to Developers.
2) Number and effectiveness of large scale Development organizations. Effectiveness here would be measurable in terms of extent of adopted products and some qualitative assessment of impact (actual and potential).

3) Extent of dissemination of practice based developments.
4) The number and quality of products developed from the whole R/D&I system and their overall (portfolio) effect. Quality would again have to be measured by usage based criteria although the locus of quality control would be a design variable.

B. Current Status and Expectations

Educational Development is plagued by a weak knowledge base. The quality of information is poor, very little has been codified. As such, quality control is a central requirement, which has only recently begun to receive serious attention but which is still relatively poorly developed and its enforcement a matter of some diffuseness as to locus of responsibility. With limited ability to depend on quality control in the field, funders and program managers may need to build quality control checkpoints into staged Development procurements, a procedure that demands closer Agency/Field involvement and orchestration than has been typical to date.

Two modes of Development which predominate in educational Development at this time are the "specialized Development organization" and "practice based" Development.

At its best the specialized Development organization represents a strong element in educational R&D system capacity. There are a few such well staffed and experienced Development organizations and their existence is an important indicator of the system building that has gone on. More often, however, the institutions and personnel involved in Development do not come up to these required standards. Even the best of these organizations tend to suffer from isolation from practice, making Dissemination and Implementation problematical. This may be one of the causes of the limited utilization of R&D based products, a shortcoming that is tending to threaten the viability of this type of institution. There may be a critical need in Development not to increase the level of effort overall (there is an inventory of more than half a million R&D products that are available for sorting, tailoring, packaging and dissemination) but rather for a shift of emphasis so as to build up more of the strong high quality Development organizations with whom the government can contract and to ensure their closer linkage to practice.

The second basic mode of Development in education (practice based) does not suffer (obviously) from poor linkage to the User. It does suffer, however, from inefficiency, lack of sophisticated skills, poor documentation of its achievements, difficulties with packaging, and from enormous problems in achieving wider dissemination and diffusion. The verdict is not in as to whether this mode can become a source for wider application (beyond the local development site). Meanwhile, further research on this mode is required as well as government efforts to supplement local capabilities (possibly through renting strategies).

In the area of project selection the emphasis to date has been on a project-by-project selection process. Missing has been the capacity in the system to consider critical portfolio effects. These could involve decisions to target and concentrate Development programs so as to achieve synergistic benefits, staging and sequencing strategies that minimize User disruption and uncertainty, cooperative ventures across agencies, etc. Particularly important may be the need to develop skills in commercialization so as to make better decisions with respect to what to place with which elements of the private sector and when.

C. Key Needs

1. Build up the explicit designing-in of quality control functions into funded Development programs - possibly including staged programs with quality control checkpoints.
2. Shift support emphasis to favor those high quality specialized Development organizations that show a pattern of being responsive to practice needs and to technical opportunity.
3. Research programs to determine the most cost effective ways of identifying and disseminating practice based Development products.
4. Investigation and trial of mechanisms to supplement local Developmental capacity.
5. Development of program planning and project selection methods by federal funding agencies that give explicit consideration to portfolio effects.
6. Explicit programs designed to achieve inter-agency cooperation for Development activities.
7. Study of and experimentation with strategies designed to improve the government funded Development organization-to-commercial firm interface -- including development of criteria for what should be handled how and by whom.

4. Dissemination

A. Assessment Basis

The function of Dissemination is critical to the entire R/D&I system. It is, in essence, a linkage process which "connects" knowledge producers with knowledge users. Thus, the R/D&I Dissemination system must provide for mechanisms which: can determine what is available; can sort out the "good" from the "bad";

will allow Users to identify and obtain the particular products which are relevant to their needs; as needed, can "tailor" products to fit User needs; can motivate Users to "try" a product; insures effective User implementation and utilization.

Assessment must be made in terms of capacity to achieve and success in each of the above requirements. Overall we would wish to know this with respect to:

(1) Extent and quality of "reach" into User systems (e.g.: number being reached, the extent of repeat utilization of Dissemination services, and User satisfaction with such service)

(2) Levels of User awareness and trial of R&D products (existence, character, and evaluative)

(3) Contribution to Implementation and Utilization of R&D products. Since this depends on such other factors as number and quality of products available, User skills and receptivity etc., the Dissemination function can only be assessed as a contributor to the process. This must of necessity be a qualitative evaluation.

(4) The existence of a well developed and cooperative network of Dissemination mechanisms giving coverage across the nation and to the variety of Users to be found.

B. Current Status and Expectations

In education, we find a number of problems and barriers to Dissemination. There are an enormous number of Users (some 19,000 school districts -- plus teachers, etc.), among whom there is wide diversity and variety as to philosophy, interests, perceived needs, etc.. Innovations make demands on the time of school personnel (a very practical matter) and generally require "people change" -- factors which can lead to resistance to innovation.

Additionally, at least two major factors have tended to create a very poor climate for Dissemination in education: (1) a lack of Implementation/Utilization support to the User; and (2) the perception that R&D products have been inferior to existing User-developed products.

In education, there has been a considerable amount of activity that has been called Dissemination, and a large number and variety of organizations are involved in some kind of Dissemination, and a large number and variety of organizations are involved in some kind of Dissemination -- but much of this has been fragmented and scattered (e.g.: "add-ons" to Development projects; successful but separate and discrete Dissemination systems for specific categorical programs).

In the past decade, federal efforts in Dissemination have focused upon the ERIC system and the state of Dissemination capacity building grants. Again, however, these are not effectively linked or orchestrated into a national "system", and receptivity with Users varies greatly. Further, there is not yet a well developed personnel base of trained Dissemination specialists. Several federally funded programs have been developed in recent years for training Dissemination and Utilization specialists, but Dissemination mechanisms are expanding far more rapidly and creating a far greater demand for trained personnel than these programs could even hope to keep up with.

From an overview perspective, then, the need is for:

1. orchestration of educational R/D&I Dissemination from a total system perspective;
2. in the short term, facilitating the work of existing Dissemination mechanisms and "filling" critical "gaps";
3. in the long-term, providing for overall system building (this calls for policies and strategies which are proac-

tive, not passive or reactive, and which are based on a knowledge of what does and does not in fact exist); and
4. balancing short and long-term needs.

More specifically, federal policies and strategies must focus upon:

1. quality control;
2. mechanisms that can optimize product/Dissemination/User "fits";
3. providing Users with alternative channels of access to the available resource base (a "mixed strategy" approach).

Federal policy will need either to expand the Dissemination training capability or slow the rate of Dissemination system expansion, keeping in mind the level and rate at which Users can absorb new input once a Dissemination system is established -- a factor which is of critical importance.

Federal policy will need to provide for systematic, ongoing monitoring of the Dissemination function.

5. Evaluation Research

A. Assessment Basis

In order to understand and assess Evaluation Research in the education context, it is important to be aware that Evaluation Research is a multifaceted R/D&I function with some potential problems and conflicts inherent within the function. It is both Evaluation (a Knowledge Utilization function) and Research (a Knowledge Production function). Its primary purpose is to reduce the level of decision uncertainty for decision makers. Thus, it has a clear, specific focus (which is the problem defined by the decision maker); seeks sufficient (not "ultimate") truth; must be "timely", within short time constraints. Yet it is also Research, to be done by Researchers who are generally used to longer time frames, to less clear "targets", to defining their own "problems", etc. There are potential conflicts of needs and interests of policy makers/funders on the one hand and of program administrators on the other. Evaluation Research may validly be needed to provide both ongoing, corrective evaluation data (Formative Evaluation) and "end-result" (Summative evaluation) -- yet the Research design for one conflicts with the Research design for the other. Evaluation Research must often evaluate programs in differing real life contexts and yet provide data which can be aggregated.

Specifically, assessments would be based on the following:

1. in general, those bases outlined for the Basic and Problem-Focused Research functions;
2. the extent to which identified centers of excellence and identified competent Evaluation Researchers are used in government sponsored Evaluation Research; and
3. the extent to which recommendations (stated or implied) of Evaluation Research are acted upon.

B. Current Status and Expectations

Evaluation Research in the social science context (of which education is a part) was strongly affected by the proliferation of large-scale federally funded social programs with attendant requirements for reporting and analysis of program effectiveness.

Of all the R/D&I functions in the field of education, Evaluation Research has experienced the most rapid and extensive development in the last ten to twelve years, both in terms of support through federal funding and in terms of an increasingly self-conscious "identity" as a separate function. Though substantial progress has been made, the field still lacks an adequate theoretical base; instrumentation is in a rudimentary state of development; basic conceptual and methodological dilemmas remain unresolved; there are relatively few persons well trained in Evaluation Research (though many more than existed ten to twelve years ago).

The bulk of federal Evaluation Research funding has gone to the private sector, with relatively little going to the university setting -- yet some evidence suggests that quality Evaluation Research comes from the academic community.

Evaluation Research in education must be done in a highly value-laden, political context -- with a multiplicity of group and interests having reason to use, dispute, manipulate or bury either positive or negative findings. Valid issues such as who controls the design and outcome of Evaluation Research must be settled within this context -- and must be settled in the early (design) stages of the process.

Educational Evaluation Research must deal with problems associated with the nature of the educational context itself: the size and variety of the education field may result in planned or unplanned design variations; multiple levels of government may need different data -- yet such potentially different data must somehow be aggregated.

C. Key Needs

System building per se is not a primary concern -- there are various Evaluation Research organizations already in the field. However, funding may need to be focused more on the academic sector -- perhaps even upon a selected set of universities and university-related organizations.

Because of the critical nature of the Design and Data Analysis stages of Evaluation Research, the best talent in the field must be utilized. This implies a relatively high degree of agency control over the selection process. In the Data Collection stage, control over selection is not a critical issue.

Policy decisions must be made early in any Evaluation Research process concerning:

1. Whose evaluation information needs are to be met (policy makers, program administrators, various levels of government, etc.);
2. The relative roles of decision makers and Evaluation Researchers in defining the problem from a specific Evaluation Research project;
3. Whether or not data shall be made public -- and when.

In a word, Evaluation Research must be done well -- and it probably will not be done well without NIE leadership in orchestrating the many complexities and potential conflicts involved.

CONCLUSION

We have throughout this report noted weaknesses in the educational R/D&I system. It is important now to re-emphasize that we have also noted that what we have found would be generally what one would expect to have found within a relatively young R/D&I system. There has been progress, and there are signs of the beginnings of a transition from the introductory stages of system development.

Thus, as we noted at the outset, the current state of the educational R/D&I system must be assessed in terms of where it has been and where it now has the potential to go -- not in terms of unrealistic expectations about "progress and output to date."

With this perspective in mind, we can see the last two decades as a period of some important achievements in the creating and building of the educational R/D&I system in the United States. As compared to twenty years ago:

1. There are today some 1500-3000 organizations (academic, private, and public) which have R/D&I capacity -- most of this capacity being relatively new and being largely the result of federal funding.
2. The personnel base has doubled (perhaps tripled) -- from around 4000 in 1969 to 8-12,000 in 1974. Most of this work force is represented by Research and Development personnel.
3. The educational R/D&I system has produced a substantial number of outputs. Some of these have been outstanding quality and of a widely reported excellence -- products from R&D organizations and exemplary products which have been identified, generalized and widely disseminated.
4. Some linkages have been developed between some of the strong Development organizations and the school systems who have been using their products.
5. USOE funding for research and training rose from $1 million in 1957 to a little over $100 million in 1969. Total Funding (federal and other) for educational R/D&I has risen from $250 million in 1968 to an estimated $576 million in 1975 -- though when inflation is considered, 1977 federal funding appears to be about 14% below 1975 levels.

6. Since some degree of maturity of a knowledge/technology base is necessary to allow its codification into handbooks and other syntheses, we may infer some beginnings of educational R/D&I system maturity from the increasing level of availability of such handbooks/syntheses.

As the R/D&I system has matured, inevitably some of the functions have developed and/or been supported more than others. It will be important to maintain a "balance" between these various functions of the educational R/D&I system. This balance must take into account for each function:

1. the time period needed to produce significant outputs;
2. the impact each function has on the other functions;
3. the level of funding needed both to maintain a balance and to maintain the basic integrity of the personnel and institutional base within each function;
4. what currently does/does not exist within each function (in terms of outputs and of the institutional personnel, knowledge and technology bases).

As we looked across the various functions within the educational R/D&I system, we noted the following:

1. The central core of institutions and personnel in the Basic Research function seems to be particularly weak (in terms of persons committed to and devoting the bulk of their careers to educational Basic Research). This points both to a need for support and a limitation on the rate at which this base may be developed. The impact of Basic Research must be viewed over a long-term (not a short-term) time frame.
2. There is a sizeable community of educational Researchers working within the Problem-Focused Research function. However, much of what is being done is small-scale and scattered, while what is often needed requires a large-scale approach.
3. In the Development function, we find a sizeable number of Development products available and there are some strong Development organizations -- though relatively few in comparison to other fields. The Development function has received a large portion of federal funding over the past decade.

4. In the Dissemination function, we find a generally weak function characterized by multiple fragmented activities. There is a need for system building -- but care must be taken not to build a system that would overwhelm User capabilities to absorb what is disseminated.
5. In the Evaluation Research function, we find the beginnings of a significant Evaluation Research community, though we must note (a) that the bulk of federal funding has gone to the private sector and (b) there is need to determine the relative potential capabilities of the academic and private sectors for high quality Evaluation Research.

With the above in mind (and considering the limited federal funding available), the following general format for federal funding of the educational R/D&I system would be relevant:

1. Provide moderate funding for Basic Research for long-term systems building purposes and to insure ongoing stability within the personnel and institutional bases. Funding should not be premised on short-term, "quick" outputs.
2. Since large scale Problem-Focused Research has been neglected, provide major funding here for system building -- but not at a level greater than the capacity of the function to absorb productively.
3. Since there are now a sizeable number of Development products available, reduce current Development funding -- to that level necessary to maintain the existing high quality centers.
4. Since Dissemination has been so fragmented, direct significant funding to Dissemination -- but not so much as to build a system that would overwhelm Users. At this time, quality control, sorting and technical service would likely need to be a part of the function.
5. Provide moderate funding for Evaluation Research for system building purposes. At this time, some emphasis needs to be

placed on clarifying the role and potential capabilities (for high quality work) of the private and academic sectors.

In summary, the period of the last two decades has been an important era of initial system building for the educational R/D&I system. There remain problems, weaknesses, critical gaps to be filled, balances to be achieved -- as one would expect to find in a relatively young R/D&I system. These identified needs become the focus for system building and rebuilding for the next transitional phase for the next five to ten years. In this period, it will be vital to provide continuity, stability and security in order that the educational R/D&I system can take root, grow and develop maturity. Only in these ways can we hope to develop a maturing educational R/D&I system which can have significant impact on the educational system in the United States.

CHAPTER THREE

STRENGTHENING FUNDAMENTAL RESEARCH RELEVANT TO EDUCATION: A Discussion of the Reports of the National Academy of Sciences and the NCER Program Committee

August 1977

CISST Project Team

Michael Radnor
Durward Hofler
Harriet Spivak

We want to express our appreciation to the many people who made helpful comments and suggestions during the preparation of this paper. In particular, we are grateful for the contributions of Peter Gerber of the National Council for Educational Research and John Mays of the National Institute of Education.

CONTENTS

Page

I. AN OVERVIEW 1

II. DEVELOPING A RATIONALE FOR ALLOCATION OF FUNDS TO FUNDAMENTAL RESEARCH RELEVANT TO EDUCATION 8

1. The Need for a Rationale for Funding Allocation Decisions 9
2. Building a Rationale for Funding Allocations 11
3. An Alternative Funding Strategy for Fundamental Research 17

III. STRENGTHENING FUNDAMENTAL RESEARCH: STRATEGIES AND ISSUES 23

1. Expanding the Purposes of Fundamental Research Funding 24
2. Selection Decisions: Projects and Areas of Fundamental Research 26
3. The Role of NIE 28
4. The Agency/Field Issue 31
5. A Potentially Dangerous Alternative Conclusion 34
6. The Use of Statistical Data 37
7. Some Other Considerations 41
    A. Assumption: Educational Practice Has Improved 41
    B. Inappropriate Optimism 42
    C. Limitations of Individual Research 43
    D. Unsolicited Proposals 44

IV. CONCLUSION 45

1. The Mission of NIE as a Lead Agency in the Educational R&D Context 46
2. Organizational and Operational Issues. 49
3. Multiple Perspectives and Purposes of Funding. . . . 50
4. Summary 52

APPENDIX 54

I. AN OVERVIEW

The National Institute of Education (NIE) is a lead mission-oriented agency for educational research and development in the United States. It is a lead agency both because it was created for this purpose by the Congress and because the scope of its mission encompasses all aspects of the educational R&D process. While NIE thus has a "lead" role, the nature of its mission and leadership can only be understood in the context of the many other parties concerned with educational R&D: various governmental agencies at the federal, regional, state and local levels; quasi-governmental and non-governmental organizations; the operational educational system (primary, secondary and post-secondary educational institutions and their administrator/teacher/student personnel at the local and state levels); and, indeed, the various individual publics whose (often conflicting) interests, needs and demands both impact and are the "end result" concern of educational R&D.

One part of NIE's overall responsibility is fundamental research relevant to education. In order to fulfill this part of its responsibility, NIE has sought the advice and counsel of the National Academy of Sciences (NAS). This advice and counsel been presented in "Fundamental Research and the Process of Education" (1977), a report of the NAS Committee on Fundamental Research Relevant to Education. In response to the NAS report, the Program Committee of the National Council on Educational Research (NCER) has presented a series of policy recommendations in its own report to NCER.

The NAS report emphasizes the importance of fundamental research relevant to education and has very correctly and capably focused on many critical aspects and requirements of fundamental research. We are in strong agreement with the report's emphasis on the importance of fundamental research relevant to education -- as we have stated in one of our earlier analyses for NIE (Radnor, Spivak and Hofler 1976). At the same time, a careful reading of the NAS report reveals some very critical deficiencies. These deficiencies could mislead NIE into developing policies and strategies which would be inappropriate and dyfunctional in terms both of NIE's overall responsibilities and of the basic intent of the NAS committee: to strengthen fundamental research relevant to education. Indeed, as we shall discuss in this analysis, such a result has already occurred in the form of the NCER Program Committee recommendations regarding funding and research community involvement -- recommendations which appear to have compounded the limitations and potential-for-error of the NAS report.

From an overview perspective, the major deficiencies of the NAS report (and the NCER Program Committee Reports) include the following:

1) NIE has lead responsibilities for all aspects of educational R&D, not just for fundamental research. While the NAS Committee was charged to examine only fundamental research, NCER/NIE deliberations cannot consider fundamental research apart from its other areas of responsibilities. The NAS report does mention

this issue -- but only marginally. In effect, the NAS report is what one might expect from a committee already biased towards fundamental research -- a bias which the NAS committee openly and forthrightly states. In a similar vein, we would expect a committee composed of educational development personnel to make a similar analysis and set of recommendations about the importance of (and the need to strengthen) development relevant to education. NCER/NIE have the responsibility to balance policies and strategies across all aspects of educational R&D -- a balance not present in the NAS report and potentially threatened by the recommendations of the NCER Program Committee.

2) The NAS report fails to examine a number of issues about the educational R&D context -- issues which significantly impact policy/strategy deliberations for strengthening fundamental research relevant to education. Among these educational R&D context issues would be: the current institutional/personnel base for education-relevant fundamental research (number and quality; interest and commitment; capability to use productively increased levels of funding -- and what levels); the rate at which the personnel/institutional base could be "built up"; the derivative, multi-disciplinary nature of educational R&D; that education is also a practice-based field where experience-based knowledge may be a vital component of the process by which new concepts and insights are developed; the relative immaturity of the educational R&D field.

3) What is the role of NIE as the "lead" agency in light of: the many institutions concerned with/involved in educational R&D; the variety of disciplines in which

fundamental research may be relevant to education; the fact that NIE is only one of many federal agencies which provide funding for fundamental research relevant to education? While the NAS report does suggest some valid and important roles for NIE relating to fundamental research, there are significant issues, roles and role options which are not considered by the NAS report.

4) While both the NAS and NCER Program Committee reports emphasize the need to strengthen fundamental research relevant to education and make certain recommendations, neither provides adequate rationales or criteria to guide the policy and strategy deliberations of NCER/NIE.

5) The NCER Program Committee has recommended that 20% of NIE's funding be allocated for the support of fundamental research relevant to education by 1979, and at least 30% by 1985. (No specific figures or dates were mentioned in the recommendations of the NAS report.) This NCER Program Committee recommendation is seriously deficient in a number of ways. No rationale is provided for the selection of these specific target percentages and dates. No analysis is provided about the impact of such a funding policy on fundamental research. Neither is analysis provided about the impact of such a funding policy on the needs of (and NIE's responsibilities for) other aspects of educational R&D (for example: need identification, applied research, and dissemination -- areas which many believe to be even weaker than fundamental research in the education context).

6) The NAS report fails to deal with the distinctions and relationships between fundamental research on the one

hand and applied research on the other. For example, the report at times seems to be making a clear distinction between fundamental and applied research; yet at other times, the report seems to use the terms almost interchangeably. As a poignant case in point, the report uses a study by Connally (1977)* as an example of the type of important fundamental research needed (p.33), when in fact, this was an applied research study on an applied problem (project selection and monitoring) in a highly applied context at NASA.** As a further illustration, the report states that a "more adequate base of scientific knowledge [i.e., presumably from fundamental research -- ed] is required before this applied research can pose answerable questions with reasonable tools" (p. 65). The implication of this statement is that applied research must always be "driven" by fundamental research -- and such is simply not the case, even in such an esoteric area as high energy physics.*** The NAS report also uses Sesame Street as an illustration (quite correctly) of "the ways in which work on an applied problem, can, in turn, advance fundamental inquiry as well" (p. 61).

However, the NAS report does not pursue this very significant point elsewhere in its discussion or in its recommendations. Further (as we shall note later), the funding recommendations of the NCER Program Committee report seem to be oblivious to this point and indeed could have the effect of preventing the advancement of fundamental inquiry through more applied contexts.

---

*Connolly, T. "Information processing and decision making in organizations. In B.M. Staw and G.R. Salancik", New Directions in Organizational Behavior, 1977. Chicago: St. Clair Press.

**CISST is very familiar with the Connally study because Connally was at the time a doctoral student of Dr. Radnor and the research was performed under Dr. Radnor's supervision.

***As seen in the Radnor, Zaltman & Kernaghan (1976) study of this field.

Finally, we might note that precisely because the distinctions between applied and fundamental research in education are not and are not likely to be clear, it is not obvious that a change in policy as suggested by the NAS and NCER Program Committee reports would have the intended effects. It is too natural (and easy) for people to "bend" the "descriptions" of their work to what is perceived as the "new" policy. Thus, the whole issue of Agency/field relationships will be central to implementation of a change in policy.

7) The NAS report makes a very strong case that education benefits from fundamental research in a variety of disciplines. As we will demonstrate later, however, there is a subtle (but potentially very real) danger that persons or agencies not already committed to education-relevant fundamental research (in contrast to the NAS committee members and NCER/NIE) would well take the NAS committee's own illustrations and discussions to conclude that there is no funding role for NIE, or even that funding for fundamental research need not be "earmarked" for education per se -- conclusions diametrically opposed to the recommendations of the NAS report.

8) The NAS report does not give consideration to the type of management capabilities NIE would need (or what it currently has) in order to play an effective role in strengthening fundamental research and/or to use increased levels of fundamental research funding for this purpose.

The NCER Program Committee report is even more deficient here because it does not deal with the management capability issues which would accompany the drastic increases in funding levels recommended by this committee.

9) Finally, as we will discuss later, the NAS committee's analysis of statistical funding data (pp. 50-60) is inadequate and misleading. The report admits that "the data needed to make comparisons are sometimes unreliable or unavailable" (p. 50) -- but then proceeds to use such data and make comparisons *as if* these data weaknesses did not exist.

Because we believe so strongly that fundamental research relevant to education is indeed of critical importance, we have chosen to submit this analysis to NCER and NIE. Our intent is not simply to be critical of the NAS report. Though we will discuss its deficiencies, we have already noted that the report does indeed highlight many critical aspects and requirements of fundamental research. Rather, our intent is to suggest issues, rationales and policy/strategy alternatives which will supplement and complement the NAS report and which will provide a more adequate basis for consideration of the recommendations of the NCER Program Committee.

We now turn to an examination of some issues critical to an analysis of fundamental research relevant to education.*

---

* A more comprehensive discussion of many of these issues is provided in an earlier CISST policy analysis for NIE (Radnor, Spivak and Hofler 1976).

II. DEVELOPING A RATIONALE FOR ALLOCATION OF FUNDS TO FUNDAMENTAL RESEARCH RELEVANT TO EDUCATION

The NAS report has recommended that fundamental research in education be strengthened -- a recommendation with which we concur. It is clear that such a recommendation has potentially significant implications for such matters as funding, NIE staffing, selection of areas and projects to be funded, etc. It is such implications which the NCER Program Committee addresses in its first recommendation ("Allocation of Funds"). Specifically, the NCER Program Committee has recommended that:

1) At least 20% of the Institute's funds shall be used to support fundamental research relevant to education by FY 1979, and by FY 1985 this shall have increased to at least 30%.

2) At least half of the minimum thus allocated (10% of the Institute's funds in FY 1979, increasing to 15% by 1985) shall be used for research grants to individual investigators or small groups of investigators.

While these recommendations attempt to address valid, significant issues, there are some critical problems with these recommendations about which NCER and NIE should be aware. The problems include at least: the lack of a rationale for the specific target percentages and dates; the lack of consideration given to the educational R&D as a total innovation process and to the impact the funding recommendations could have on other aspects of educational R&D; the lack of consideration given to critical aspects of the educational R&D context.* As the discussion will indicate, consideration of such concerns may well suggest an alternative set of funding policies and strategies.

---

*The NAS report (upon which the NCER Program Committee recommendations are presumably based) is also deficient in considering these concerns.

1. The Need for a Rationale for Funding Allocation Decisions

First, the Program Committee provides no specific rationale for choosing either the percentage targets or the target years. Presumably, the recommendation is based upon the recommendation of the NAS report to strengthen fundamental research relevant to education. However, the NAS report neither specifies nor provides a rationale for selecting target percentages or years.* Thus it is not clear why 20% and 30% were chosen instead of, for example, 15% and 25%, or 10% and 35%, or 25% and 40%, etc. Similarly, it is not clear why 1985 was chosen instead of, for example, 1980 (an immediate increase to a specified percentage) or 1990 (a more gradual increase). Nor is a rationale provided for selecting a target year at all. Indeed, we will suggest later that a target year not be specified. We are suggesting, then, that while decisions about levels of funding are required, such decisions must be based upon sound rationales -- rationales not provided by the Program Committee. Later in this discussion, we will suggest such rationales.

Second, while it is valid to consider the need for strengthening fundamental research relevant to education, this cannot be done in isolation from consideration of other areas of educational R&D and of NIE's responsibilities in these areas. Specifically, NIE also has responsibility for and must give consideration to the educational R&D-related functions of need identification, applied research, development and dissemination, and implementation/utilization. In light of its responsibility for educational problems and practice, NIE must also give consideration to such matters as policy research and training/technical assistance for users of educational R&D outputs. In addition to considering each of these areas individually, NIE must also give consideration to orchestration and system building across these areas. Simply put, NIE msut consider educational R&D as a total process of innovation. Thus, there are a number of critical concerns which must be considered in development of policies and strategies for strengthening fundamental research. However, these are concerns which are not addressed by the NCER Program Committee in its recommendation and only marginally by the NAS report.

---

*In its discussion (p. 54) of Table 3 (p. 55), the NAS report does mention a "one-third" figure. However, this referred to fundamental research as being one-third of total research allocations, not one-third of a total budget.

A third area of concern which must be considered is the actual context of fundamental research in education. Critical questions must be raised as to the rate at which quality fundamental research relevant to education can be built up; the ways in which the multidisciplinary, derivative nature of education might impact policies and strategies for strengthening education-relevant fundamental research; the fact that funding for education-relevant fundamental research in a variety of disciplines is provided by a variety of federal agencies; etc. Again, these are critical issues not addressed by the NCER Program Committee recommendations or by the NAS report. As we have noted elsewhere, consideration of such issues leads to consideration of both funding and non-funding policies and strategies.* Here, however, we will limit the discussion here to the issue of funding allocations.

---

*Radnor, Spivak and Hofler (1976). Increasing funding is perhaps the most "obvious" strategy for strengthening fundamental research relevant to education. It is very important to recognize, however, that strengthening fundamental research in the education context is not just a funding issue. It also involves developing linkages, building system capacity, selecting projects and areas for research, etc. These are issues we will be discussing later in this paper.

2. Building a Rationale for Funding Allocations

There are at least several critical considerations upon which funding decisions for education-relevant fundamental research should be based. (We are assuming here a common agreement that education-relevant fundamental research is indeed important.)

First, excellence is critical to fundamental research in any field. As the NAS report correctly notes (p. 5), "relevance" in fundamental research is essentially meaningless if the research is of low quality. Funding low quality fundamental research programs or projects may add quantity but not quality to the fundamental research base and would simply be dysfunctional and wasteful. Further, we may note that funding levels which are greater than can be used effectively by high quality researchers/research institutions invites application by and distribution of funds to low quality researchers/research institutions. Thus, as the NAS report emphasizes, funding must be provided in a manner which carefully selects high quality programs/projects and "screens out" low quality programs/projects.

Second, if excellence is a critical requirement, then the capability of the field to absorb and use productively increased levels of funding for fundamental research programs/projects is limited by the available base* of high quality fundamental researchers and fundamental research institutions. This is a funding implication which is not raised as an issue by the NAS report. Simply put: the fewer the number of available high quality fundamental research personnel, the lower will be the level of funding for fundamental research projects which can be productive.

Third, the current base of fundamental researchers and research institutions also limits the rate at which the fundamental research field can be "built up" -- for it is the existing fundamental research personnel and institutions which provide training for new fundamental research personnel. Further, training of new, high quality fundamental researchers does take time. These considerations are constraints on the ability to "improve" or "strengthen" fundamental research through increased levels of funding -- and again, these are issues not considered in the NAS report.

---

*Current and as augmentable in the near term.

There is a basic question concerning the structure of fundamental research relevant to education that must be dealt with and which was not considered in the NAS report. Granted that education has historically been a field that is practice-based and largely derivative of research from a variety of disciplines, the question arises as to how important it is, if at all, that there be a core of fundamental research activity within education itself (and/or by researchers whose long-term and major commitment is to education). Is it likely to be healthy for education to be entirely a derivative field or is there a need for a significant level of research effort in fundamental areas that comes from within education (possibly in some loosely defined sense)*? It is clear that the core of researchers that are primarily committed to education has been small and weak to date -- though it does exist (and was even represented on the NAS committee making the study). A major policy issue is the extent to and rate at which such a core should and can be built. Furthermore, it is vital that we better understand the extent to which the size and health of such a core does or does not represent a constraint on the healthy growth and flow of useful insights that can come from supporting potentially relevant research in the contributory disciplines. And finally, what is to be NIE's role with respect to fundamental research carried out by those with major versus peripheral commitments to education, as compared to other sources of funding for these areas of fundamental research? Such questions are not easily resolved. They should have been an important aspect of the NAS analysis. They should be the subject of further study by NIE. We take a tentative position that such a core is likely to be important and that education has suffered from the lack of such a strong core.

---

* We are definitely not implying by this the need for such work to go on only in schools of education. The issue is one of commitment.

In the present educational context, the existing base of high quality educational fundamental researchers (i.e., those committed strongly to education) is small. This would imply some constraint on funding levels. On the other hand (as has been well noted by the NAS report), education can derive benefits from fundamental research in other disciplines which do have established, sizeable, high quality personnel/institutional bases. Here, however, there is also a constraint. Education research tends to have low prestige, complicating efforts to attract competent researchers to this field.

A fourth consideration is that educational R&D includes not only fundamental research but also need identification applied research, development, dissemination and other areas relevant to educational R&D and its application within the operational system of education. Here, consideration must be given to the need to balance NIE's responsibilities across each of these areas; to the need for a balanced rate and level of development across each of these areas; and to NIE's responsibility for the impact of educational R&D on the educational operating system. Here, then, several basic questions must be asked which are not asked in either the NAS or NCER Program Committee reports.

1) What are the needs in all of these areas for which NIE has responsibility?

The Academy report has concluded that education-relevant fundamental research should be strengthened. However, because educational R&D is relatively young in this country, all educational R&D areas need strengthening, though in varying degrees. In particular, we would note that some people consider need identification, applied research, dissemination and implementation/ultilization to be areas which have even more "need" for "strengthening" in the educational context than does fundamental research.

2) What are the relative levels of funding required for significant impact across the various educational R&D related areas?

The point to be made here is simply that compared to applied research and development, the costs for significant fundamental research are relatively small. Both applied research and development have requirements of scale several degrees of magnitude significantly larger than the scale requirements of fundamental research. Differences in sectors and disciplines make precise analogies difficult.* In areas such as drugs and chemicals (which involve "hard" sciences and which have very high levels of industry involvement), funding may be as much as ten times greater for applied research (and one hundred times greater for development) than for fundamental research. In the "softer" social sciences, the differences in magnitudes of funding may not be so great -- but they are still significant. In the social sciences, funding for applied research typically is two-to-four times greater than for fundamental research, with the ratio between development and fundamental research being even higher.

---

*We recognize that in the education context, applied research is often done in a "small-scale" mode. However, the fact that applied research on a large-scale mode appears to be largely absent in the education context may be a weakness worthy of concern.

The implication of the above is that funding for fundamental research can be increased significantly without undermining the funds available (and needed) for other R&D functions. At the same time, there is also an implication that funding levels for fundamental research are not typically 20% to 30% of the total combined funding for fundamental research, applied research and development.

3) What impact would various levels of funding for fundamental research have on NIE's ability to fulfill its responsibilities in other educational R&D areas?

The NCER Program Committee has recommended that 20% of NIE's budget be allocated to fundamental research by 1979 and 30% by 1985. This recommendation can be properly evaluated only in the context of NIE's responsibilities for all aspects of educational R&D (need identification, fundamental research, applied research and development), as well as for dissemination and implementation/utilization of the outcomes of educational R&D. Allocation of 30% of NIE's budget to fundamental research would leave only 70% of NIE's budget for its other R&D -related responsibilities. Since applied research and development both tend to require much higher magnitudes of funding than does fundamental research, the effect of the NCER Program Committee's recommendation would likely be to weaken NIE's capacity to meet funding needs for applied research and development -- as well as funding needs for NIE's other areas of responsibility.

Consideration must also be given to the fact that NIE does have fixed expenses for administration (12-14% of its budget in recent years) and other commitments for which funding is allocated (e.g.: contractual commitments; programmatic commitments such as the implied three to five year commitments to SEAs involved in the State Capacity Building Program; Congressionally mandated commitments such as are found in NIE's reauthorizing legislation). Fixed expenses and commitments cannot be automatically removed or reduced to re-allocate funds to fundamental research (or to any other R&D-related area of concern). Since fixed expenses and commitments already represent a significant portion of NIE's budget, increasing NIE's fundamental research allocation to 20-30% could be accomplished only by using funds from the "uncommitted" portion of NIE's budget -- thereby significantly reducing the level of the discretionary portion of NIE's budget. This simple fact raises at least two serious questions about the NCER Program Committee's recommendations.

a) Would the "remaining" uncommitted portion of NIE's budget be adequate for NIE to fulfill its other R&D-related responsibilities?

b) Would NIE have the level of flexibility and discretionary use of funds it needs to respond to anticipated or unanticipated changes in the educational R&D context, promising new developments in any area of the total educational R&D

process, the need to "balance" the levels and rates of maturation across all educational R&D functions, etc.?

It must be noted that the above discussion is not meant to imply or suggest specific funding amounts or percentages for fundamental research or for any aspect of educational R&D. Such determinations are the responsibility of NIE and NCER and are beyond our capability or intent. What is intended is to suggest that the issues discussed above are the types of considerations which should be used to provide the rationale for decisions about specific funding allocations for fundamental research -- and indeed for all funding allocations.

It is also intended here to suggest that allocating 20 - 30% of NIE's budget to fundamental research is quite likely to be dysfunctional to NIE's capability to meet its total responsibilities.

There is one further comment we would make here. Stability over time is very important for fundamental research. Thus, while we recognize that percentages can be a useful tool for administrators, we do question the wisdom of allocating a total budget percentage (10%, 20%, 30% or whatever) for fundamental research. If NIE's budget were to increase significantly, a total budget percentage basis might well result in more funding being assigned than the personnel/institutional base of fundamental research could usefully absorb. Contrarily, if at sometime NIE's budget were to decrease significantly, a total budget percentage basis would require cutting funding allocations to fundamental research projects -- thereby introducing an instability which would likely be dysfunctional.

3. An Alternative Funding Strategy for Fundamental Research

In light of the above discussion, the need is for a funding policy/strategy for strengthening fundamental research which is both effective and feasible (given constraints discussed above and the need for "balance"). Based upon the above discussion, we would suggest the following as an effective and feasible alternative. While this alternative assumes there will likely be an increase in the level of funding for fundamental research relevant to education, we do not here intend to suggest a specific level of funding. That would be beyond our capabilities and is the responsibility of NIE. This alternative also assumes that analyses and estimates will be made (and taken into consideration) about such issues as: the levels of funding which the fundamental research personnel/institutional base is currently capable of using productively; the relative need for funding across all aspects of the educational R&D process; etc.

1) NIE would establish a target-dollar-amount level for NIE funding of fundamental research relevant to education. The target dollar amount level would likely be greater than the current dollar amount level.

   Discussion: The use of a target-dollar-amount level for increasing NIE funding of fundamental research would serve several purposes and would have several advantages over a percentage-of-budget basis for funding. Both dollar-amount and percentage-of-budget formats would demonstrate the commitment of NIE to a policy of strengthening fundamental research. Both would provide goals or "targets" to be reached. However, a target-dollar-amount basis for funding would also allow NIE to relate funding to the capability of the field to use funding productively and would protect fundamental research funding from fluctuation or instability in NIE's budget. A percentage-of-budget basis for funding would not serve these purposes.

The specific target-dollar-amount level would be established on the basis of realistic estimates of probable NIE budget levels, the capability of the field to productively use funding and consideration of NIE's mission responsibilities.

2) The target-dollar-amount level would be reviewed at approximately five year intervals.

Discussion: It is not assumed that a specific target-dollar-amount level, once set, is either "written in stone for all times" or based on "perfect wisdom". The target level does represent (1) a definite commitment which (2) is based on well-considered judgment. At the same time, there must be review mechanisms which can take into account such context changes as significant changes in NIE's overall budget levels, increased capability of the field to use funding productively, etc.

While a review process is needed, the process must be neither too often nor too seldom. If performed too often (e.g.: annually), there is not adequate time to "measure" and "weigh" the changes noted above; the danger of instability is re-introduced; and the concept and force of "commitment" is undermined. Contrarily, if the review is performed too seldom, (e.g.: every 10 years or more), adaptation to context changes may come "too late" to be effective and the concept of "review" becomes operationally meaningless. Thus, we suggest the review be performed approximately every five years.*

---

*On the assumptions that NIE's overall budget level is a key factor and that it is most subject to significant change as a result of political dynamics, consideration might be given to a four-year review cycle, performed in the second year of each Presidential term. There would be both benefits and dangers to this approach, but discussion of these is beyond our scope here.

3) In order to reach the target-dollar-amount level specified as policy, NIE would establish as policy an annual-incremental-percentage growth of NIE's fundamental research budget.

Discussion: Any increase in NIE funding for fundamental research must take into account (1) the current capability of the field to use productively increased levels of funding and (2) the rate of development of the field over time. An annual-incremental-percentage basis for increasing fundamental research funding takes both of these factors into account. Indeed, the specific annual percentage set as policy would be based on informed estimates of these two factors. Additionally, this strategy is based on the perspective that the nature of fundamental research in general (and specifically in the education context) calls for a steady rather than a one time/short term "spectacular" rate of growth.* The specific annual percentage would also be subject to review approximately every five years for the same reasons as noted above.

The percentage formula recommended here is a percentage of NIE's fundamental research budget, not of NIE's total budget.

4) NIE would establish as policy that funds set aside for fundamental research would be used only when programs or projects meet the criterion of researcher and/or research institution excellence (and any other criteria established by NCER/NIE).

---

*If deemed wise and feasible, the incremental percentage could be higher in the first year both in order to "signal" NIE's commitment to the field and to bring the level of fundamental research up to the level at which the field is currently able to use funding productively.

Discussion: This policy operationalizes the valid concern of the NAS committee that low quality fundamental research is meaningless no matter how "relevant" it might appear.

5) Provision would be made that for any given fiscal year, the annual percentage growth may be temporarily suspended for a one-year period, with the complementary provision that the level of funding already reached would not be reduced.

Discussion: We have stressed the importance of not providing levels of fundamental research beyond the capability of the field to use productively. An inflexible growth in funding levels does not take this factor into account. The above provision provides the needed flexibility -- i.e., if at any time NIE finds that the level of productive funding has "peaked" (temporarily), it may suspend the annual increase in funding levels. Simultaneously, stability would be provided in that the level of funding already reached would not be reduced. The intent of a policy of annual increases in funding level would be protected by the provision that a suspension would be for one year only. Continuation of the suspension (if valid) would require an annual decision.

6) No target year would be established for reaching the target dollar-amount level.

Discussion: Setting a target year may "sound good" at first glance, but it is unnecessary and the effect is simply to rigidify the process, thereby leaving NIE less able to adjust the process to the capability of the field or to changing conditions (e.g.: a period in which the Congress does not provide for the increases in NIE's budget needed to increase allocations to fundamental research).

7) As part of the implementation of the above policies, NIE would continually monitor the capability of the field to use fundamental research funding productively.

Discussion: This provision, necessary for the implementation of the policies and strategies suggested above, could well be implemented as part of a total KPU monitoring process. This provision would also serve the "secondary" purpose of developing/maintaining a close contact between NIE and the field.

III. STRENGTHENING FUNDAMENTAL RESEARCH: STRATEGIES AND ISSUES

The basic conclusions of the NAS report are that fundamental research relevant to education is important, that it has been given low priority and that it should be given higher priority. In a word, the basic conclusion of the NAS report is that fundamental research relevant to education should be strengthened. Given this premise, it becomes critical to determine how this "strengthening" can and should be accomplished -- i.e., how the objective of "strengthening" can and should be operationalized.

Probably the most obvious approach is to increase the level of funding allocated for fundamental research relevant to education. However, as the discussion above has implied, increased funding must be seen as only one aspect (admittedly an important aspect) of an overall set of interactive policies and strategies. Thus, it now becomes critical to ask the "larger picture" questions: What is the range of policies and strategies which might be considered? What are their "pros" and "cons"? How do they fit into a synergistic "portfolio"* of policies and strategies? What are the critical set of issues involved? What can and should be the relevant roles of NIE and the field?

Both the NAS and the NCER Program Committee reports recommend a set of policies and strategies which do indeed go beyond the "level of funding" issue. Nonetheless, there are significant strategies and issues which are not (or not adequately) considered in either report.

---

*The concept and importance of a "portfolio" approach is discussed in Radnor, Spivak and Hofler (1976).

1. Expanding the Purposes of Fundamental Research Funding

It is reasonable to assume that a major purpose of increasing the level of fundamental research funding is to increase (through an increase in the number of projects funded) the base of scientific knowledge about education. This is a very valid purpose. At the same time, there are other purposes which are suggested by the nature and context of fundamental research relevant to education. Specifically, as we have noted in an earlier analysis for NIE:

> The central core of Basic Researchers, those committed to and devoting the bulk of their careers to educational Research, seems to be particularly weak in this field, especially when compared to Basic Research in most other fields. In education, this core group tends for the most part to be located in schools of education, in departments focused on each of a number of derivative disciplines (e.g., educational psychology, educational sociology). Consideration of these settings as the primary institutional bases for Basic Research in education suggests that there are relatively few centers of excellence and a great deal of mediocrity. Also, when one makes the distinction between numbers staffing these departments and numbers carrying out significant amounts of Basic Research, the relatively small size of this core, and its scattered condition, become apparent.
>
> A somewhat different picture emerges when one examines Basic Research relevant to education carried out in discipline-based university departments (e.g., departments of Psychology or Sociology). Here, there is considerable Excellence, and these disciplines often provide valuable inputs and contributions to the education knowledge and technology base. The problem, however, is that the commitment of discipline-based Researchers to the field of education tends to be variable and shifting over time. After all, their primary commitment is to their discipline, and education takes a secondary role.
>
> Taken together, these two conditions create an educational Research community that tends to be unstable and amorphous, thus complicating the problem of relationships and of maintaining communication flows among the parts of the system. (Radnor, Spivak and Hofler 1976, pp. 29-30)*

---

*As noted earlier, we recognize that the need for a "core" of education-oriented fundamental researchers is an issue which needs further discussion.

The implication of the above discussion is that fundamental research project funding should be based on a multiple purpose strategy. That is, in addition to the purpose of strengthening the base of scientific knowledge about education, project funding decisions should take into consideration such additional, system building purposes as:

1) creating a vital, stable core of high quality fundamental researchers who are committed to education-oriented research;
2) facilitating and sustaining communication and collaboration across education-relevant disciplines and across the many agencies and institutions which fund fundamental research relevant to education.

These purposes imply project funding strategies which seek to maintain relationships with researchers beyond the life of a specific project, which seek to develop "centers of excellence", which support training programs for educational fundamental researchers. Indeed, these purposes and strategies would appear to be essential if NIE is to take seriously its mandate to "build an effective educational R&D system." While Recommendation No. 7 of the NAS report (and related discussion on p. 75) begins to address such purposes and strategies, we believe that such system building purposes and strategies of fundamental research funding should be given considerably more emphasis and consideration than provided by the report.

There is one further issue that should be considered here -- the political issue. NIE is a federal agency and as such it is (and has been) subject to "political" dynamics. Because "political" dynamics tend to be "short term" in nature, they pose a potential threat to the more long term stability needed for fundamental research. With this point in mind, we are concerned that by focusing attention on the importance of fundamental research "outputs", the NAS report might lead to Congressional expectations of short term "results" -- despite the valid cautions of the report to the contrary. In making its "case" to the Congress, it would seem advisable for NIE to focus (1) on the need for strengthening the educational fundamental research community (and its linkages) and (2) on multipurpose strategies for doing so -- with the illustrations of the NAS report providing support for the long-term validity of system-building.

2. Selection Decisions: Projects and Areas of Fundamental Research

NIE specifically requested that the NAS committee identify areas of fundamental research having potential significance for education and describe areas of research they would deem to deserve high priority. Clearly, if NIE is to be involved in the funding of fundamental research relevant to education, NIE staff must be provided with some guidance from the field to inform the inevitable selection decisions that will have to be made. Whether the fundamental research funding policies of NIE entail (1) a focus on a few areas in which projects will be funded or (2) a totally open, 100% field initiated approach, choices will have to be made from among proposals submitted. Further. since a variety of disciplines are relevant to education, there is potentially a broad array of relevant research areas from which project proposals could be submitted.

Thus, some criteria other than the relative merits of submitted proposals are likely to (and indeed must) enter into selection decisions -- even when panels of distinguished researchers are used to make selection decisions. Distinguished researchers, after all, do have their own individual biases and perspectives. Thus, the research areas, methodologies, etc. that are funded are likely to be heavily influenced by the simple act of selecting distinguished researchers for the review panel. Therefore, there is really no way to avoid the problem; decisions are going to reflect the conscious or unconscious choices among research areas as having greater or lesser potential relevance for education, potential significance for strengthening the scientific foundations of education, etc.

It is reasonable to suggest that NIE's fundamental research funding decisions need to be based on some understanding of at least the following:

1) the spectrum of fundamental research areas with potential relevance to education;
2) the state of development of each of these research areas:
3) lines of inquiry that are being pursued; how, where and by whom; with what kind of results, and how such results might have potentially significant application to education;
4) the state of readiness for educational application in different areas of inquiry (i.e., are there some lines of inquiry that are so well developed that it becomes feasible to concentrate on a few central problems of questions which may lead to insights and/or outcomes of fundamental significance to improving our understanding of the educational process or how we think about education?);
5) how well different areas are (or are not) being funded by other federal agencies;
6) which areas seem to have reached a temporary saturation for funding high quality fundamental research;
7) which areas could expand most rapidly with the help of increased funding (given the availability of personnel and centers of excellence able to expand their training capacity at different rates);
8) where the potential for synergy across agencies and/or projects seems most likely.

We do not here deny the argument made by the NAS committee -- that given the uncertain nature of fundamental research, one can never predict with complete accuracy where the most important break-throughs are likely to be, what applications are likely to follow from what lines of fundamental research, etc. Still, some reasonable, informed estimates are not outside the realm of possibility, and this seems to be all that NIE was requesting from the NAS committee. Funding decisions will be made regardless of what recommendations the NAS committee makes; and since decisions are almost always made on less than perfect information, any information which could reduce the uncertainty level of such decisions by improving the quality of information available to decision makers would certainly seem to be a decided plus. Distinguished researchers from the field would seem to be the best possible source for at least part of this information. Thus, it is a serious failing of the NAS committee that they were unwilling to provide any of the guidance NIE requested about "promising" areas for fundamental research. In effect, the NAS committee took the far easier task of selecting illustrative examples aimed not at providing guidance for selection decisions but rather simply at persuading the reader that fundamental research does have potential relevance for education. Certainly NIE and NCER do not need to be so persuaded. By redefining their task and thus producing the kind of report they have presented, the NAS committee has, in our view, provided a potentially useful public relations document (though as we will later note, it could have a negative effect on some readers) in support of fundamental research relevant to education, but has provided little of the kind of guidance NIE needs to assist its staff in developing a fundamental research funding policy or making specific decisions regarding the implementation of such policies.

3. The Role of NIE

By virtue of its Congressional mandate to "build an effective educational R&D system", it is obvious that NIE does have a role in the strengthening of fundamental research relevant to education. It is thus now time to examine the nature of that role. To do so, it is necessary to consider the context in which NIE exists and in which fundamental research relevant to education occurs -- a context which includes: the multi-disciplinary, derivative nature of fundamental research relevant to education; a relatively young educational fundamental research system in which there are many loosely-linked participants; several major federal (and other) funding agencies (of which NIE is only one).

The educational context for fundamental research has two main characteristics. First, it is multi-faceted. Educational fundamental research is derivative from many disciplines and thus involves many participants, each with somewhat different perspectives and interests. There are several major federal (and non-federal) funding agencies involved -- of which, NIE is only one. Second, the educational fundamental research community is relatively young (rather than "mature") -- and its linkages are weak. In such a context, there are three particular "lead" roles which seem necessary but which could only be provided by an agency or institution whose scope is nationwide and multi-disciplinary and whose primary mission is education-oriented. NIE is just such an institution. Indeed, given its Congressional mandate, NIE is the only institution in a position to perform these very necessary roles.

As has already been implied in the discussion thus far, one NIE role is to provide leadership in system-building. At the very least, this role implies the need for policies and strategies which would:

(1) facilitate the development of linkages among disciplines, among funding agencies, and among fundamental research personnel;

(2) provide for the training of education-oriented fundamental researchers;

(3) build and strengthen "centers of excellence" for education-relevant fundamental research;

(4) provide stability;

(5) increase the "status" of educational research.

A system building role also implies that the system-building potential of a specific project should be a major criterion for project selection decisions.

A second role of NIE is closely related; i.e., the role of orchestration. At the very least, this role implies:

(1) facilitating communication across disciplines and among fundamental research personnel;

(2) taking a lead role to identify particular areas of fundamental research which appear to have particular significance for education;

(3) taking a lead role to coordinate fundamental research programs and projects across funding agencies in order to develop synergy across such programs and projects;

(4) linking fundamental research to "upstream" and "downstream" R&D functions.

Implied in the orchestration role is yet a third role for NIE -- a coalescing role. We may note that fundamental research relevant to education may be characterized as being highly "scattered". It involves a variety of disciplines -- each with a variety of research areas potentially relevant to education. Funding for education-relevant fundamental research is "scattered" across many funding agencies. Education is generally a "secondary" concern in these varied disciplines and funding agencies. The education-relevant fundamental research "community" is at best loosely and weakly linked. Education-relevant research is not per se of "high status". Thus, there would seem to be a strong need for coalescing the diffuse, scattered elements of education - relevant fundamental research. At the very least, this role would imply:

(1) scanning the various education-relevant disciplines to identify potential for synergy across lines of research;

(2) facilitating and supporting the development of linkages within and across fields.

4. The Agency/Field Issue

A basic issue in R&D is the role of the field in relation to the role of a major funding agency, an issue which we have addressed in a policy analysis for NIE (Radnor, Spivak and Hofler 1976). Both the NAS and the NCER Program Committee reports focus strongly on this issue in their recommendations. Though their recommendations differ somewhat in specific details, both reports recommend the following kinds of roles for the field:

1. A review role (e.g.: to review proposals, quality and balance of programs, etc.);
2. A role of assistance to NIE (e.g.: to identify research needs, to develop guidelines, to plan);
3. To initiate fundamental research projects.

Additionally, the NCER Program Committee recommends that 50% of NIE's fundamental research funding be allocated to "individual investigators or small groups of investigators."

Both reports, then, suggest a strong role for the field. However, there are issues which we feel need further consideration and clarification than provided in either report. While we have discussed these issues at more length elsewhere (Radnor, Spivak and Hofler 1976), we will review them briefly here.

One issue is the level of consensus among researchers in the field about such considerations as: identification of key questions in need of answers, adequacy or appropriateness of different methodologies, lines of research which appear to be most promising, etc. Where field consensus is low, it would seem more appropriate for a funding agency to work closely with (but clearly not be directed by) the field to determine areas and projects for funding. That is, the agency would "be fairly active in molding and selecting from what the field has to offer rather than just responsing to scattered field-initiated proposals"*. On the other hand, where field consensus on key issues is high, such an Agency role would seem less necessary -- i.e., a mode of being highly responsive to field initiated proposals would be quite appropriate. Thus, it is incumbent on NIE to determine the level of field consensus on key fundamental research issues before setting a fixed policy about field initiated proposals. However, pending such a determination, it appears to us that in many areas, fundamental research relevant to education is more nearly characterized by low rather than high consensus. If this is indeed the case, the "lead" roles of orchestration and coalescing become especially important.

A second (and related) issue is the need for system capacity building in relation to fundamental research relevant to education. As we noted earlier, this need implies that projects should be considered in terms of their potential for system capacity building as well as in terms of their quality and substantive output. An "overview" agency such as NIE is more likely than the field to have an "overview" perspective of total system building needs and to be specifically concerned with this issue.

The basic implication of the above discussion is simply that there are "lead" roles which can only be performed by a major funding agency such as NIE and that these "lead agency" roles are especially important when an R&D system such as that in education is relatively young and not really "mature". We do note here that while NIE may validly be considered a lead agency for fundamental research relevant to education, there are other federal agencies (e.g., NSF) which fund fundamental research relevant to education -- some at levels greater than that provided by NIE. Thus, NIE's "lead" role must be understood in terms of the intersection and interaction of its lead role with the lead roles of other relevant funding agencies.

Having said this, it is now important to balance the discussion by again noting that both the NAS and NCER Program Committee reports are correct in emphasizing that the field must have a strong role in the funding process for fundamental research relevant to education. Fundamental research _is_ an uncertain process. It _is_ difficult to determine which lines of research are "most promising." The knowledge and perspectives of researchers are needed if adequate evaluations are to be made of the quality of research proposals.

The practical question at this point might seem to be: How can the "lead" role of NIE and the "strong" role of the field be reconciled? Actually, this is the wrong question -- it implies that the Agency/field issue is an "either/or" issue. We would suggest instead that the nature of fundamental research in the educational context requires a highly collaborative Agency/field relationship. To illustrate, we have suggested that NIE should

---

*Radnor, Spivak and Hofler (1976:33).

not be directed by the field in project selection. However, the field should be strongly involved in reviewing project proposals -- as is validly recommended by both the NAS and NCER Program Committee reports. Similarly, while NIE must take a "lead" role in the process of identifying areas of "promising" fundamental research relevant to education, it must seek the advice and counsel of the field.

In order to develop and maintain such a close, collaborative relationship with the field, we would suggest (as does the NCER Program Committee report) that NIE have fundamental researchers on its staff* -- though we recognize that attracting quality research talent to NIE is not a simple task. Indeed, we would recommend that NIE research personnel continue to be involved in research and have as a major responsibility maintaining close contacts with other members of the field.

Through a close, collaborative mode of Agency/field relationships, the Agency/field "issue" is no longer an "either/or", "us vs. them" issue. Rather it becomes simply an issue of determining the appropriate modes of collaboration. Indeed, if NIE has active researchers as part of its internal staff, NIE becomes, in one sense, a part of the field.

5. A Potentially Dangerous Alternative Conclusion

The NAS report was prepared by a committee composed of personnel who candidly admit their strong and pre-established commitment to fundamental research. It is not surprising, then, that the NAS committee concluded that fundamental research is indeed important for education. Similarly, the report was requested by and submitted to NIE -- which has its mission the support of educational R&D. Thus, it would be reasonable to expect NIE (and NCER) to be supportive of this conclusion.

---

*The NAS report recommends only that NIE staff be "well informed about research" (p. 79).

The issue here, then, is not whether the conclusion of the NAS report is right or wrong -- or whether groups such as those above will find the report persuasive. Rather, we are concerned about the impact the NAS report might have on persons or groups who are not already "predisposed" towards (or who may even be predisposed against) the conclusions of the report. Given the political context in which NIE (and its funding) exist, this is just as important an issue as the validity of the report's conclusion. We think that the report could, unfortunately, be misinterpreted by persons "un-predisposed" towards fundamental research.*

In order to demonstrate forcefully the need for educational fundamental research, much of the NAS report is devoted to demonstrating that fundamental research in a variety of disciplines has provided (and thus can be anticipated in the future to provide) benefits for education -- and this argument of the report is indeed persuasive. However, it is precisely this persuasiveness which could provide a basis for what we consider to be wrong and dysfunctional conclusions. Specifically, there are two possible issues here: the allocation of fundamental research funding with a specific focus on education; and the role of NIE.

---

*Subsequent to the initial draft of this policy analysis, at least one Congressional staff member has raised the type of issues discussed in the paragraphs which follow.

The NAS report has correctly noted that it is difficult to predict which specific lines of fundamental research (and in which disciplines) are likely to be most significant for education. At the same time, the report does make a strong case that education has indeed benefited from fundamental research in a variety of disciplines. If these two (quite valid) considerations are taken alone and out of the larger educational R&D context (as an "un-predisposed" reader might well do), it would not be unreasonable to suggest that funding allocations for fundamental research need have no specific reference to education per se. Such a position does have some validity -- i.e., education can expect to benefit from fundamental research in a variety of fields regardless of whether or not the term "education" is applied. The NAS committee does not provide a rationale to the contrary, and indeed, does not really raise or discuss this issue. We believe the issue should be raised and a rationale delineated. Specifically we suggest (as discussed earlier) that it is possible to make reasonable, informed judgments that certain lines or areas of fundamental research have a high level of potential relevance to education -- and should be funded (and orchestrated) as such: relevant to education.

Assuming for the moment agreement that funding should be provided (even increased) for fundamental research relevant to education, the question could be raised whether or not NIE should have a role in the funding process; and if so, what role. The NAS report has made a strong case that education has historically derived benefits from fundamental research in a variety of disciplines -- research funded for the most part by agencies which are larger, more well-established than NIE and/or are more directly related to specific relevant disciplines (e.g.: NSF, NIH, NIMH). If this is the case, it would be reasonable to ask why all federal funding for education relevant to fundamental research should not be channeled directly to such other federal agencies. In the absence of a rationale for an NIE role, such would be a quite reasonable question. The NAS report lacks a clear and forceful statement of such a rationale -- and herein lies a potential danger of the report. The rationale for an NIE role is simply the strong need for a lead role of system building, orchestration and coalescing across disciplines (as well as across the several major funding agencies) -- and NIE has been mandated by the Congress to provide these lead roles.

6. The Use of Statistical Data

When statistical data is used in any analysis, it is important both to recognize the limitations of the data and to stay within these limitations when drawing conclusions or implications from the data. The NAS report does make initial disclaimers that (1) the way a federal agency allocates its funding is a "far from perfect" measure of an agency's commitment; and (2) "the data needed to make comparisons are sometimes unreliable or unavailable" (p. 50). We further recognize that the statistics used in the NAS report (Tables 1-6, pp. 51-59) are the most relevant available statistics. Nonetheless, in a number of instances, the report does use the available data in ways that appear to be inappropriate and misleading. This can be illustrated in Table 3 (p. 55) and related discussion (p. 54) in the NAS report.

As presented in the report, Table 3 includes dollar amounts that were allocated in FY 1975 to basic and applied research by a variety of federal agencies. Estimates are provided from two separate sources. Percentages are included only for sub-totals and totals -- not for each separate agency. From Table 3, the report concludes that: "Both sets of data show that, overall, basic research receives about one-third of the total research support. This proportion is even smaller (22-29% of all research) in the agencies identified by the NRC Study

Project on Social R&D as directly concerned with research in education. Basic research is smallest (15-20% of all research) in the Office of Education and the National Institute of Education."

A more detailed analysis of Table 3 raises serious questions about these conclusions, and about the NAS committee's use of available statistical data. If the dollar amounts provided in Table 3 are translated into percentages (specifically: basic research as a percentage of total research allocations), we obtain the results shown in Figure 1. When Figure 1 is used as a basis for a closer scrutiny of Table 3 than is provided in the NAS report, a number of implications may be drawn that challenge the conclusions of the NAS report.

1) The NAS report concluded: "Basic research is smallest (15-20% of all research) in the Office of Education and the National Institute of Education" (p. 54). This statement is highly misleading in several respects. First, it compares OE and NIE with the average of thirteen other agencies, agencies which are significantly different in mission and whose individual percentages range from 0% to 100%. Second, when NIE is considered separately, Estimate 1 places NIE quite high (e.g.: 47% for NIE cp. 37% for NIH; NIE, at 47%, is higher than all of the other agencies except for NSF and Smithsonian). Third, as discussed elsewhere by us and by the NAS report, education has been a largely derivative field. Thus, NIE and OE do not represent the total enterprise for fundamental research relevant to education.

2) The NAS report concludes that the "average" percentage of total research funding allocated to basic research is 33-35%. Granted that this is a mathematically true assertion. It is also a meaningless assertion. Individual agencies range from 0% to 100% allocation of total research funding

Basic Research as Percentage of Total Research

Agencies Engaged in Some Education Research (Study Project on Social R&D)	Estimate 1. Programs for Research in the Behavioral and Social Sciences (National Science Foundation) Basic Research in Behavioral/ Social Sciences	Estimate 2. Research Projects Relevant to Schooling and Other Formal Education, Selected Agencies Only (Interagency Coordinating Project) Basic Research in Education
Department of HEW:		
National Institute of Education	47%	11%
Office of Education	0%	21%
Subtotal: Average	20%	15%
Office of Ass't Secretary of Education		80%
Health Division	37% (NIH)	80% (NICHD, NINCDS) 33% (OHD)
Department of Agriculture	24%	73%
Department of Interior	11%	
Department of State	0%	
Department of Commerce	under 2%	
Smithsonian	100%	
Department of Labor	4%	0%
Department of Defense	20%	26%
Veterans Administration	5%	
Subtotal: Average	(22%)	(29%)
Other Agencies Whose Research is Relevant to Education		
National Science Foundation	72%	70%
Alcohol, Drug Abuse, and Mental Health Administration	44%	29%
Health Services Administration	-0-	100%
Social and Rehabilitation Service	0%	-0-
Average	33%	35%

FIGURE 1 *

BASIC RESEARCH FUNDING AS A PERCENTAGE OF TOTAL RESEARCH FUNDING OF SELECTED FEDERAL AGENCIES

*Adapted from Figure 3 in: National Academy of Sciences, "Fundamental Research and the Process of Education" (1977).

to basic research. It would be meaningful to compare NIE with other specific agencies -- provided that the nature and relevance of the comparison are identified (e.g.: similarity of mission). However, this is not done in the NAS report.

3) The NAS report attributes a high level of significance to the fact that both the "Estimate 1" and "Estimate 2" data, show basic research receiving about one-third of total research support as a composite average for all agencies combined. Given the above discussion and the fact that there is no data for several agencies in "Estimate 2", we question that this statistical fact has any real meaning.

4) Finally, we would note the rather extreme differences between "Estimate 1" and "Estimate 2" in relation to several agencies (e.g.: NIE, OE, Health Division of HEW, Department of Agriculture). These differences highlight the limitations of available data and suggest the need for caution in drawing conclusions from the data.

We may note briefly here another aspect of the discussion of statistical data in the NAS report. There are differences between federal agencies as to the aspects of the total R&D process for which they have concern or responsibility. Since NIE has a responsibility for all aspects of a total R&D process (including dissemination and implementation/utilization), one must be very careful in comparing NIE funding data with funding data for agencies which have more limited areas of concern and responsibility. In a similar vein, in some fields we find the major funding for applied research, development, dissemination and even implementation utilization being provided by industry. In the education context, there is no such equivalent -- at least not on a comparable scale Thus, the demands on NIE's budget for (as an example) applied research and development are likely to be stronger than the demands on the budget of (for example) NIH. These differences also make analogies difficult, imprecise and potentially misleading. While the data available to the NAS committee does not make comparative analysis an easy task, the NAS report does not seem to take these issues adequately into account in its discussion.

7. Some Other Considerations

The discussion thus far has served to illustrate a range of issues relevant to the reports of the National Academy of Sciences and of the NCER Program Committee. There are additional issues which need to be addressed. Limits of time and resources prevent us elaborating on these for now. As illustrative of just a few of these issues we provide the following annotations of several points made in the NAS report. At this point we will merely provide the appropriate quotation from the report together with brief comments.

A. Assumption: Educational Practice Has Improved

> We can also see that the quality of education as a human experience has undergone marked improvement over the years, not only between some distant historical point and now, but also within the lifetime of most adults. The curriculum of schools and colleges, for instance, has never been more varied in scope and variety. High school students are learning now what was once thought to be college-level material, and elementary students are acquiring skills that used to be taught in high school. While some might argue that it has become too ambitious and that we should not be trying to teach so much to so many, there is no doubt that the varied fare that schools offer today is an advance over the three Rs of our grandparents' day. (pp. 17-18)

Does the discussion of the NAS committee on pages 17-18 reflect a rather "liberal bias" rather than a "disciplined inquiry" perspective? There are those who doubt that today's varied educational fare is an improvement (or at least has been at the expense of) the "three Rs". Would not the "back to basics" movement be a direct (and widespread) challenge that there is "no doubt that the varied fare" of today "is an advance over the three Rs"? Similarly, recent actions in La Crosse, Wisconsin (where the community recalled and defeated School Board members who had dismissed a "strong disciplinarian" Superintendent) reflect what may be a more widespread and growing trend back towards strong internal school disciplinary practices. Are the people who call for "basics" and "discipline" wrong? On the basis of what fundamental research are they "wrong"? Even if one accepts the NAS committee's particular perspective of "improvements" in educational practice (improvements at least indirectly traceable to fundamental inquiry), this perspective is "hindsight". A critical issue becomes how one can distinguish, at any present moment, which lines of research and/or related practice applications are "sound" and which are "fads" (and even "bad" fads). How can the educational R&D community inform or "warn" the practice based educational community about the limitations or weaknesses of implications which are prematurely drawn from the tentative and/or limited findings of a specific line of fundamental research? These are pragmatic and value issues which are a part of the "reality" of the educational context but which are not addressed by the NAS report.

B. Inappropriate Optimism

> These illustrative projects are not atypical of education R&D, nor are projects like them exclusive to education R&D. In our judgment, they represent an ill-advised tradeoff of scientific quality and future understanding for promises of immediate products and superficial benefits. To be fair, we must note that the promises have not always been made by administrators. Researchers themselves have sometimes approached their work with inappropriate optimism about the speed with which science might yield results that would inform practice.

4

> Conclusion. The application of science and technology to improve education is of great importance. On the whole, however, we believe that the federal government has adopted policies that encourage superficial and wasteful research that has the appearance of relevance but lacks the substance of general principles. We recommend a significant redistribution of emphasis toward more fundamental research in education and toward a more measured approach to education R&D of all kinds. The current resources for doing so are clearly sufficient. (p. 66)

The NAS report is correct in challenging the validity of promising or expecting "too much too soon" from particular fundamental research projects, and has also correctly noted that federal policies can have the effect of encouraging such "inappropriate optimism". However, the report does not specify which federal policies are inappropriate -- or how and why. Nor does the report analyze the political aspect of the educational R&D context, identify any other causes for "inappropriate optimism", or suggest ways of alleviating this problem. The report does seem to imply that a greater emphasis of fundamental research would "alleviate" this problem. We fail to see the rationale or logic of this conclusion and indeed suggest that as a sole strategy, increased "emphasis" would not impact the problem.

C. Limitations of Individual Research

> Federal agencies and the public are understandably concerned about the time required to solve problems through science or to get "answers" from research. In part, as we have observed, the outcomes of research have been misunderstood. But also, the time required to formulate and to carry out productive research is usually underestimated. We emphasize that this time cannot be reduced significantly by programming sequential activities, tightly supervising laboratories, dividing labor according to function, or "buying" clusters of research. The individual is at the heart of fundamental research and he or she needs time to think, worry, and proceed with "gradualness." (p. 68)

The NAS committee's primary concern here is to emphasize (1) the time and (2) the modus operandi for fundamental research. These are correct and needed emphases. We specifically agree that "programming sequential activities" and "tightly supervising laboratories" are inappropriate. Neither do we challenge that the importance of the role the "individual" researcher can have in the fundamental research process. However, we do challenge the implication that an "individual" approach is the only (or even the main) approach to fundamental research. Such an implication does not take cognizance of recent trends towards the use of teams in fundamental research in a number of areas (e.g.: in empirically based areas).

We also question the report's conclusion against "buying" clusters of research. Although the term "buying" has negative pejorative connotations, there are reasons to consider funding "research clusters", whether such "clusters" be research areas or research centers. The earlier discussion in this paper about selection decisions has implied that concentrating on a research area (through a "cluster" of supported projects) may at times be prudent. Similarly, the need for system capacity building suggests a strategy of supporting "centers of excellence" -- i.e., institutions where there is a "cluster" of fundamental research personnel.

D. Unsolicited Proposals

> It is the Committee's opinion that the most productive tool yet devised for managing research without destroying freedom of inquiry is the research grant awarded after peer review of unsolicited proposals. (p. 69)

There is no real "evidence" for this statement, which reads more like an "assertion" than an "opinion". Nor does the discussion here take into account how unsolicited and agency-suggested proposals should be viewed in terms of issues discussed in this paper such as "lead" agency roles, agency/field relationships, selection decisions re. lines of research, etc.

IV. CONCLUSION

We stated at the beginning of this paper that in two key areas, we strongly agree with the conclusions of the NAS and NCER Program Committee reports: i.e., that fundamental research relevant to education (1) is important and (2) should be strengthened. At the same time, we have in this paper suggested some critical issues which have not been adequately addressed in either report. We have further suggested that consideration of these issues is necessary for the development of appropriate policies and strategies -- and for the rationales and justifications upon which such policies and strategies must be based. We have noted that consideration of a broader range of issues than those provided in the two reports leads, at times, to conclusions and recommendations different from those in the two reports; at other times, the result has been to support their recommendations and strengthen the rationales behind them.

It has been our intent in this paper to be illustrative rather than comprehensive. Certainly, there are other issues which need to be considered and other policies and strategies which can be developed. We do believe that the issues raised in this paper are critical issues and that these issues do demonstrate the type and range of issues -- and related policies/strategies -- which should be considered by NIE and NCER.

As one looks across the range of issues discussed in this paper, three major requirements emerge that over-arch the specific points of concern:

1) that NIE's policies and strategies regarding education-relevant fundamental research must be based on a clear understanding of NIE's mission as a lead agency in the educational R&D context;

2) that organizational and operational issues related to NIE's mission must be considered:

3) that a variety of policies and strategies (including but not limited to funding) for strengthening education-relevant fundamental research need to be considered.

1. The Mission of NIE as a Lead Agency in the Educational R&D Context

The discussion in this paper points to a critical need for a clearer understanding of NIE's mission which can be used to guide policy and strategy decisions regarding all of NIE's responsibilities -- including fundamental research. The "starting point" and general framework of NIE's mission is, of course, provided by NIE's authorizing legislation. At the same time, it is important that an agency such as NIE also take a proactive, self-defining stance in defining its mission. This at least involves:

- determining the meaning and intent which underlie the language of NIE's authorizing legislation;
- developing a vision of what NIE's mission should be in light of a close examination of the nature of and needs in the education context;
- "spelling out" NIE's mission even more precisely in terms of directions; critical needs; relationship with NIE's constituencies, other funding agencies, and the various education-relevant disciplines; operational implications; etc.

Thus, while NIE obviously must start with it's authorizing legislation as a general framework for defining its mission, NIE must also make a self-determination whether the scope of its mission should be more comprehensive or less comprehensive; what should be the major foci or emphases at any given point in time; what "mission"

is appropriate given the character of education (as a derivative field, as partially craft-like, etc.) and in the light of the state and stages of development of educational R&D in its various aspects;
what is realistic within the constraints of funding;
and in this case what are the specific mission implications for fundamental research in education.

We recognize, of course, that defining one's mission is not a "precise science", perhaps especially in the political context of a federal agency and in the value-laden context of education. Thus, any understanding or statement of NIE's mission could (and likely will) be debated and would be subject to change over time. Further, we also recognize that at times a certain amount of "vagueness" about one's mission may be "the better part of wisdom".

Nonetheless, we believe that NIE should give immediate and serious attention to developing a clear internal understanding and consensus of its mission -- as well as to developing such an understanding with other education-relevant funding agencies and with NIE's "constituents". Otherwise, NIE will continue to be subjected (internally and externally) to non-resolvable and debilitating debates about policies and strategies, to a lack of consistency and balance in its policies and strategies, and to periodic (and time/energy consuming) "rehashing of the same old issues ".

As part of an understanding of its mission, NIE must also give early and serious consideration to what it means to be a lead agency. Certainly, this role is implied (1) in the very establishment of NIE as a separate agency; and (2) in the establishment of a Federal Council on Educational Research and Development -- composed of "representatives of Federal agencies engaged in research and development relating to education" and chaired by the Director of NIE.

Further, consideration must be given to what it means to be a lead agency in the *education context*. As we have suggested, this will require consideration of such needs as system-building in a relatively immature, diffuse and highly "derivative" field; of orchestration roles in relation to other agencies, to the varied relevant disciplines, and "participants" in educational R&D and educational practice; of the "practice-based" nature of education. Consideration should also be given to such issues as the extent to which there needs to be a "core" of researchers whose primary commitment is to the field of education. Finally, consideration should be given to the intersection and interaction of NIE's lead roles with the lead roles of other agencies concerned with educational R&D and with education-relevant fundamental research in particular.

Considerations of mission, lead agency roles and the educational context do lead to specific policy/strategy implications and even requirements. While it is not our role in this analysis to determine what these will be, we have in our earlier analysis (Radnor, Spivak and Hofler 1976) provided illustrative scenarios of how these considerations could lead to specific planning and funding policies and strategies.

In light of the above discussion, we recommend that NIE give immediate and serious attention to:

1) defining its *overall* mission as a lead agency in educational R&D;

2) determining the kind of leadership which is required and/or feasible for NIE to fulfill its mission as a lead agency in the educational R&D;

3) defining NIE's mission regarding education-relevant fundamental research *both* in relation to education-relevant fundamental research per se *and* to NIE's overall mission.

It is our position that the deeper issues involved in determining NIE's posture and programs with respect to fundamental research cannot be properly dealt with in the absence of these determinations.

2. Organizational and Operational Issues

If NIE is to fulfill its mission regarding fundamental research relevant to education, early and serious attention must be given by NIE to a wide range of organizational issues concerning how NIE should be structured, how it should operate, how it should be staffed.

For example:

How is NIE to relate to/work with other funding agencies?

How can NIE best keep in close touch with and work with the "field"?

How can NIE obtain the information it will need to make selection decisions of what program areas to fund?

How should NIE manage and supervise the projects it funds?

Does NIE now have a program management capability which is adequate and appropriate for its fundamental research mission?

The point to be emphasized here is that simply increasing funding for fundamental research without dealing with such organizational issues is not likely to be very productive. For example, if NIE does not have personnel who understand a particular research area and are "in touch" with the relevant research personnel, serious question must be raised as to what significant (or valid) role NIE could have in that particular research area.

Among the organizational issues which NIE should consider would be at least the following:

1) having competent fundamental researchers on NIE's staff -- and having them actively involved in research;

2) determining appropriate roles for the field; appropriate ways of relating to the field; and appropriate methods for involving the field (e.g.: appropriate uses of panels, conferences, workshops, exchanges, etc.) in selecting, funding and working with those sub-specialties selected as targets for NIE support and attention.

3) determining appropriate ways of working with other funding agencies in order to orchestrate fundamental research efforts across agencies and disciplines;

4) determining appropriate uses of well-developed state-of-the-art reviews, knowledge syntheses, etc.;

5) monitoring the educational fundamental research context.

Thus, we recommend that in planning policies, strategies and programs for strengthening education-relevant fundamental research, NIE give early and serious consideration to identifying and developing appropriate responses to organizational issues such as (but not limited to) those noted above.

3. Multiple Perspectives and Purposes of Funding

Any examination of fundamental research in the education context is likely to reveal that education-relevant fundamental research should be strengthened and that NIE funding for fundamental research can be somewhat increased without "damaging" the balance of NIE funding for other areas of educational R&D. However, the funding issue needs to be examined from a variety of perspectives and in terms of multiple-purpose strategies. To illustrate:

1) In determining levels of funding for fundamental research, NIE must first give consideration to the needs of and NIE's responsibilities in other areas of educational R&D and practice. Consideration must then also be given to the field's capability to use and NIE's capability to "manage" particular levels of funding for fundamental research. These considerations would seem to indicate that applying 20-30% of NIE's total budget to fundamental research would be unnecessary, inappropriate and potentially dysfunctional. As we have suggested, a more realistic strategy would be an incremental, measured and monitored annual increase over NIE's current level of funding for fundamental research.

2) Policies and strategies for strengthening fundamental research relevant to education should give consideration to such purposes as system building and orchestration across disciplines and funding agencies.

3) Policies and strategies for strengthening fundamental research relevant to education should involve careful selection of research areas* for funding. In selecting such research areas, consideration should be given to whether or not they are:

    - areas which provide opportunities for orchestration and synergy across projects;

    - areas where NIE can have a significant impact in terms of orchestrating the efforts of several funding agencies, system building, etc.;

    - areas which informed judgment indicates potential significance for education;

---

*By topics and by sub-specialties; it is our belief that disciplines and general fields represent a much too broad research spectrum.

- areas where "excellence" exists or can be built;
- areas where "seeding" is needed and could be productive.

4) Recognition must be given to the fact that the "genesis" of significant fundamental research may come from applied research and -- in a "craft-like" field such as education -- from practice.

5) It may well be that the rationale for an immediate increase in funding levels is most validly based on the need for NIE to "signal" to the field NIE's commitment to fundamental research and to stability in NIE's ability to fund and manage fundamental research.

It is imperative, then, that NIE view an increase in the level of funding for fundamental research as only one aspect of a broad-based funding policy.

4. Summary

In conclusion, while we have said that we support an increase in NIE funding to fundamental research, it is our strongly held position that in the absence of specific resolution of and attention to required policies, resources, structures, and programs, such an expansion should be measured and incremental and not of the radical nature recommended by the NCER Committee (20% to 30% of budget). We also oppose the use of such formulae for fundamental research funding policy.

Among the areas requiring such specific attention are the identification of fundamental research areas in terms of current capabilities of the field in various areas; potentials for synergy; potential for developing "centers of excellence"; potential for relatively "near term" significant results, etc.; organizational issues, including NIE's current program management capabilities; defining

NIE's mission and the nature of what it means to be a lead R&D agency in the education context; the relative need for funding across the various educational R&D functions; whether or not there needs to be a "core" of researchers whose primary commitment is to the field of education.

APPENDIX A

We have included as an appendix an editorial from the August 26, 1977 issue of Science which discusses some of the same issues that we have reviewed in this paper.

26 August 1977, Volume 197, Number 4306 · SCIENCE

How Fares Basic Science?

When the elders gather to assess the spirit and substance of science, apprehension is invariably expressed about the state of basic research. Thus, it was only normal for the recent summer meeting of the Committee of Scientific Society Presidents to vote that "basic science is in trouble."

This is a useful, and suitably gloomy, battle cry to raise on the eve of the annual jousting exercise of budget-making. Unfortunately, the quality of the supporting evidence leaves much to be desired. Is basic science in grave trouble, in significant trouble, or in *some* trouble? Is it equally in trouble in government and in industry—or is there a great difference: a tale of two cities? What are the properties of the trouble—financial, political, institutional, attitudinal, or managerial? How much of the trouble is self-inflicted? It would be helpful to have answers. Lamentation is not enough, and basic science is not homogeneous.

As has been said before on this page, basic science long ago drifted amiably into the arms of government at the price of those checks and balances which go with pluralistic support. It should not come as a surprise to learn that the marginal industrial and foundation dollar has been driven out of the picture. It has also been noted that although government has been a very good friend of basic science, everything considered, it provides an erratic and uncertain environment for long-term research because it has not yet come round to treating basic science as *investment*, in contrast to year-to-year expense. This library of familiar music is likely to play for some time.

What becomes important now is the question of productivity in basic science. Instead of measuring "trouble" strictly in terms of rising, falling, or steady-state budgets, we need to ask different questions and apply different tests. It may very well be that built-in inefficiencies and distractions are sapping the vitality of the research process and that the dollars allocated to basic science no longer tell us much about the true levels of research effort.

Which factors operate to devalue the basic science dollar? The indirect cost surcharge on research grants is a familiar kind of burden, but not the only one. Countless man-months are subtracted from research effort in order to satisfy the routines of renewal application, accounting, reporting, and compliance with the rising tide of governmental and institutional regulations. Obsolescence of instruments and equipment, together with queuing delays, works to drop the blood count of research. The torrent of what passes for scientific and technical information presents obstacles through which investigators must blast or tunnel their way. This is the enervating dimension of basic science as it must be practiced now, and little of it meets the unwary eye. Would it overreach by too much to say that, compared with the environment of a decade ago, the research dollar has been devalued, in terms of productivity, by one-third?

With zero-based budgeting coming on strong, and a balanced federal budget being scripted for 1981, prospects for growth of support for basic science are problematic. The normal revenue growth under present tax laws will be claimed by defense, welfare reform, energy development, and perhaps a national health insurance program. Three-quarters of the government's budget is already relatively uncontrollable, leaving a very narrow area for discretionary expenditure, and it is in this cramped and bitterly competitive corner that basic science is to be found. Given all this, there are strong incentives for isolating those influences which undercut the productivity of basic research at existing support levels.

Basic science has known lean times. But a combination of austerity, industrial disinclination, continuing inflation, and falling productivity could prove to be too much. If the science adviser, the National Science Foundation, and the scientific community would take a close look at the issue of productivity, a brighter light might be shed on the sources of "trouble" in basic science.—William D. Carey

APPENDIX B

A second appendix we have included here is a report to the National Institute of Education (1977) entitled "Fundamental Research and the Process of Education".

FUNDAMENTAL RESEARCH AND THE PROCESS OF EDUCATION

Final Report to the
National Institute of Education

by the

Committee on Fundamental Research Relevant to Education
Assembly of Behavioral and Social Sciences
National Research Council
National Academy of Sciences

Sara B. Kiesler and Charles F. Turner, Editors

Washington, D. C.

1977

COMMITTEE ON FUNDAMENTAL RESEARCH RELEVANT TO EDUCATION

Sheldon H. White (CHAIRMAN), Department of Psychology and Social Relations, Harvard University
Merle L. Borrowman, Dean, School of Education, University of California at Berkeley
Remi P. Clignet, Department of Sociology, Northwestern University
John P. Crecine, Dean, Social Sciences and Humanities, Carnegie-Mellon University
Donald C. Davidson, Department of Philosophy, University of Chicago
James G. Greeno, Learning R & D Center, University of Pittsburgh
Alex A. Inkeles, School of Education, Stanford University
Philip W. Jackson, Department of Education, University of Chicago
Eleanor B. Leacock, Department of Anthropology, CUNY-City College, New York
Sara L. Lightfoot, Graduate School of Education, Harvard University
Amado M. Padilla, Department of Psychology, University of California at Los Angeles
John W. Porter, Superintendent of Public Instruction, State Department of Education, Michigan
Roy Radner, Department of Economics, University of California at Berkeley
Sandra Scarr, Institute of Child Development, University of Minnesota
Richard F. Thompson, Department of Psychobiology, University of California at Irvine
John G. Truxal, School of Engineering, State University of New York at Stony Brook

Staff

Sara B. Kiesler, Study Director
Charles F. Turner, Research Associate
Benita A. Anderson, Administrative Secretary

CONTENTS

Preface

Chapter 1: Introduction.......................... 1

Chapter 2: Fundamental Research and Education... 7

Chapter 3: Fundamental Research Topics Relevant to Education................ 19

Chapter 4: Federal Policy....................... 45

Conclusions and Recommendations.................. 77

References....................................... 81

Appendix A: The Impact of Fundamental Research on the Educational Literature: An Analysis of Citation Patterns....... 89

Appendix B: Research Programs in the National Institute of Education and the Office of Education.................110

Bibliography.....................................114

PREFACE

The Committee on Fundamental Research Relevant to Education, constituted in June 1976 by the National Research Council in cooperation with the National Academy of Education, was formed in response to a request from the National Institute of Education (NIE). One of the legislative charges to the Institute is that it seek to improve education in the United States by strengthening its scientific foundations. In light of that charge, Dr. Harold Hodgkinson, Director of the Institute, asked the Committee to recommend how that strengthening might be accomplished, by identifying promising lines of fundamental research, assessing the adequacy of federal support, and recommending changes in policy, if any, needing consideration by the National Council on Educational Research or other appropriate bodies.

This Committee did not conduct a scientific research project. We were asked, because of our experience and expertise as scientists and educators, to express some judgments about research and federal policy. We did not feel constrained--and were not asked--to suspend our initial belief in the value of fundamental inquiry for education. As persons who have committed our careers to fundamental research as well as to applied research and education, this belief was, and remains, strong. Nor did we feel it necessary to collect large amounts of new empirical data. There is much that we have learned over the years and much that others have learned. There exist numerous sources of information already available from reports, papers, and books on the topic of research and education. Our task, as we conceived it, was to review with each other our knowledge and perspectives and to learn from documents and colleagues outside the Committee. Our search for information and our discussions, while lengthy and to the point, were not so much exhaustive investigations as they were a form of shared reassessment of our judgments.

The Committee did try to solicit comments as widely as possible and to familiarize itself with all the pertinent literature. For example, we systematically reviewed previous reports and evaluations of change in education and the effects of research (see Bibliography), undertook a limited citation study of the flow of research information (see Appendix A), and collected information on the performers of basic research by examining current journals, books, and nationally distributed magazines and the recipients of research awards. Some of us examined the research cited in books that had had national impact on education.

The focus of much of our study was on research designed to understand the processes of individual learning and human development, the organization of social institutions, and interpersonal interaction. We reviewed only briefly applied research and work that translates basic research into educational materials. Our major concern with regard to applied research and development was to evaluate its scientific foundation.

We did not evaluate fundamental research on the subject matter of education, such as mathematics and physics. This decision was largely due to our limited time and expertise. During a one-day meeting, we did consult with a special mathematical and physical sciences panel of the Committee, whose members were George Pimentel (University of California at Berkeley), Henry Pollak (Bell Laboratories), Frederick Reif (University of California at Berkeley), Frank Westheimer (Harvard University), Hassler Whitney (Institute for Advanced Study), and Bernard Witkop (National Institutes of Health).

Our evaluation of research policy was focused mainly on the National Institute of Education, because of its mandate to improve the scientific foundation of education. Our review of the Institute and its programs was as comprehensive as we could make it. We examined at length and in detail the current spectrum of research support now maintained by the NIE and familiarized ourselves with its working structure. We interviewed program officials, examined budget documents and actual spending in detail, reviewed projects proposed to and supported by the NIE, and investigated provisions for maintaining scientific feasibility and quality. In addition, we reviewed the funding and management of educationally relevant research by the various governmental agencies that now offer such support. Among these are the Office of Education and the National Science Foundation. (During our deliberations the latter began a new program for research in science education.)

Our task in formulating and writing this report was made lighter than it might have been because many individuals helped. First, Philip Jackson, one of our own Committee members, deserves thanks. In an essay he wrote for the Committee, he captured our conception of the process by which research is diffused. A revised version of this essay constitutes Chapter 2 of this report.

The Director and Associate Directors of the National Institute of Education and several other past and present program officials provided much of the assistance we needed. They were both cooperative and sympathetic with our requests for information, quick answers to questions, and discussion. We especially wish to thank Dr. John Mays, who, as the Science Advisor of the NIE, was responsible for transmitting to us the largest portion of the information and background materials needed. He was invaluable as a source of historical background and citations.

Many others contributed at various stages of our work. For example, our initial search for information on both research and policy was aided by the directors of a large number of associations, who announced to educators and researchers our request for suggestions. In response to this request, we received over one hundred letters, visits, or calls. In addition, Christopher T. Cross, a knowledgeable staff person from the Congress, spoke to our Committee about congressional views. The aforementioned panel of mathematical and physical scientists commented on the first draft of this report and met with us for a day. Dr. David A. Goslin, Executive Director of the Assembly of Behavioral and Social Sciences, and Dr. James G. March, of the NIE Council, also met with us and provided valuable suggestions. There were a large number of unwitting helpers, too, among whom we count the originators of the reports listed in the Bibliography and the authors of books on educational problems and organizations.

The revisions of this report have received careful scrutiny by reviewers within the Academy. These reviews, many of which were written in great detail, were extremely helpful; we owe our thanks to these anonymous reviewers. We are grateful, too, to Eugenia Grohman, Editor and Executive Associate of the Assembly, who helped us structure the report, and to Christine L. McShane, Assistant Editor, who critically edited the report and supervised its production.

Finally, we wish to thank Benita A. Anderson, the Administrative Secretary of our Committee, who not only typed the many versions of the report but was our primary research assistant, collecting information from journals and reports and collating by hand the large number of citations used in the study reported in Appendix A.

In conclusion, we joined the Committee with strongly held views about the nature of fundamental research and preferences regarding the lines of inquiry most worth pursuing. Another committee might have had somewhat different opinions. We tried to avoid narrowness on our Committee by reading and consulting widely, but we did not attempt a systematic survey of scientists and educators, nor did we try to achieve consensus on all aspects of the report. We do not presume to represent all our colleagues in this report nor to suggest that every part of this report represents the opinion of every Committee member. We did, in the end, find that the areas of agreement among Committee members were much greater than the areas of disagreement. As a whole, this report presents our collective judgment on those aspects of fundamental research relevant to education that we have been able to examine in these few months, and our recommendations regarding research policy represent some hard thinking and reflection on the part of each of us.

Sheldon H. White
Chairman, Committee on Fundamental
Research Relevant to Education

CHAPTER 1

INTRODUCTION

The modern conduct of education--through schools, colleges, training programs, television, publishing companies--touches every one of us in more ways, for more hours of the day, and probably with greater effect, than ever before. Possibly that is why education is so much in the news and is much of what seems to be behind the news. To many people, the quality and quantity of education seems connected with their own and their children's chances for success, important social problems such as unemployment and crime, and the nation's stature. Our social, political, and economic ills and expectations transcend education, but the perceived importance of "getting an education" to alleviate problems and achieve dreams is significant. Nearly all of the government's major social programs have an education component. Therefore, when scientists and scholars turned their research toward the understanding of education, people hoped for practical improvements in instruction as well as the alleviation of apparently related societal problems. The questions sometimes raised by these hopes, and nourished by the evidence of moon landings, antibiotics, and atomic energy, are how soon and with what effect does research on fundamental processes bear practical fruit? These questions find pointed expression in the phrase, "That's very interesting, Professor, but what's its relevance?"

This report on fundamental research addresses the issue of relevance by aiming at three questions that we, a committee of scientists and educators, believe are useful for a serious discussion of national research policy for education: "What do you mean by relevance?" "What kinds of fundamental research have potential relevance?" "How can federal policy strengthen fundamental research relevant to education?"

Our answers to those questions take the following form: first, what makes fundamental research relevant is the improved knowledge it generates, which in turn is a condition for more useful views of how education takes place, new visions of what is educationally possible, stronger commitments by those who educate, and improvements in instruction and educational institutions. Second, the kinds of fundamental research that have potential relevance derive from a broad range of inquiry focused on basic questions concerning how people mature, learn, and interact and how social institutions affect them. Third, federal policy for fundamental research relevant to education should be designed or redesigned to improve the quality of work of those who conduct research and their working environment, to enlarge the scope of fundamental inquiry, and to provide adequate resources for its development.

These conclusions derive from our views of research and how it is administered. We believe that fundamental research relevant to education is basically a development of ideas for explaining how and why education occurs across places, time, and groups of people. The quality of this development is reflected in the validity of the new concepts and understanding that gradually diffuse to educators and the public, where it stands its ultimate test: the degree to which educators, students, and citizens find the new ideas more useful, more sensible, than the old ways of thinking. In turn, the quality of fundamental research depends heavily on the standards of those engaged in it and on their resources for systematic observation and careful analysis, building upon the work of others, responding to emerging possibilities, and examining the many realms in which basic educational processes occur. These resources depend on two factors insufficiently represented in the practice of federal policy today--commitments to financial support and flexible management that encourage self-directed fundamental inquiry.

Definitions

Defining the subject matter of this report proved to be difficult. The colloquial definition of education is imprecise--to some it means schooling, and to some it means more than that. Our discussions of fundamental research relevant to education hinged on our agreeing on a definition of education itself.

In Western society, the classical definition of education is intellectual development, or learning. The Latin origins of the noun, education, convey the notion of a leading out of ignorance. Plato recommended geometry as a course of serious study, not for the practical advantages it might afford in battle or everyday life, but rather because "geometry will draw the soul towards the truth and create the spirit of philosophy and raise up that which is unhappily allowed to fall down . . ." (*The Republic,* Book 7). Echoing this attitude over 2,000 years later, John Henry Cardinal Newman argued that the advantages of advanced education are "in one word, the culture of the intellect" (*The Idea of a University,* 1852).

While this definition of education is simple, it is not entirely consistent with that of many Americans. In the minds of many, education means schools, colleges, and other institutions that, in turn, are called on to provide many functions other than intellectual development. Thus, "education" can be viewed as a means for socializing children,[1] providing day-care, vocational training, conferring status or credentials, and stimulating national development. When, in a recent survey, parents were asked to rank the relative importance of various attributes of their children, intellectual curiosity ranked tenth (after characteristics like honesty and good manners) and success in school was twelfth. Letters to the Committee from researchers and educators also showed a range of expectations for educational institutions. In these letters, 40 percent emphasized that learning should be their primary function, but 60 percent mentioned training for occupations, good citizenship, mental health, or national development. These views suggest that if intellectual development were the only outcome of schooling, parents would not expect their children to spend at least twelve years in school, and the public would not spend an average of over $15,000 per child on schooling. More to the point, it suggests that our discussion would be too narrow were we to focus on intellectual development alone.

---

[1] Article 26 of the United Nations Declaration of Human Rights says, "Education shall be directed to the . . . strengthening of respect for human rights and fundamental freedoms. It shall promote understanding, tolerance and friendship among all nations, racial or religious groups, and shall further the . . . maintenance of peace" (Dec. 10, 1948).

We have decided to use, for the purposes of this report, a two-dimensional definition of education. On one hand, education is personal and intellectual development or learning, which may occur either inside or outside schools. On the other hand, education is what educational institutions do, or are expected to do. It is our belief that fundamental research is relevant to education to the extent that it leads to an understanding of these domains.

What is fundamental research? The Committee decided, arbitrarily, that there was no need to make a distinction between the traditional term "pure science," the popular "basic research," and "fundamental" research. Basic research need not be equated, as it once was by many, with laboratory work or research conducted exclusively in academic departments. We believe it has come to mean disciplined research to discover general principles, but not necessarily by a particular academic or methodological route. Thus, for example, some of the work of psychologists on learning from Sesame Street, conducted on the site where the program was developed, is basic research, truly fundamental to understanding how children learn.

Fundamental research in education is disciplined inquiry whose purpose is to understand why and how education takes place. These processes are the subject matter of the behavioral and social sciences, such as economics, sociology, political science, psychology, and anthropology, and some of the humanities, such as philosophy and history. Our ability to comprehend the basic activities of education, to recognize and articulate problems, and to suggest ways and means for solving them depends heavily on the knowledge developed by these sciences and humanities.

Objectives

As a guide to the Committee's work, the National Institute of Education (NIE) asked us to consider three questions:

1. What are the principal lines of research being pursued at the present time that are significantly strengthening the scientific foundations of education, and what are some of their possible contributions to American education? Are there some lines of research that appear particularly promising and deserving of higher priority than they are now given?
2. Are current modes of conduct and support of fundamental research relevant to education adequate to ensure its quality and ultimate usefulness to education? If not, how might they be improved?

3. In light of answers to the above, what possible additions to or changes in policy relevant to fundamental research, if any, are reccommended for consideration by the National Council on Educational Research or other appropriate bodies?

We began our examination of these questions by defining, operationally, the specific issues we would address and the array of work we would evaluate. Three major considerations affected our decisions. First, we were asked to prepare a draft of the report in nine months; second, we did not wish to repeat what other groups had done recently; and third, we wanted to allocate our limited time to those issues we felt were most important and about which we were most knowledgeable.

The first question asked of the Committee by the Director of the NIE received considerable discussion and study. Implicit in the task requested—that of identifying lines of fundamental research having potential significance for education and describing research deserving of higher priority--was the more basic task of articulating how fundamental research makes a contribution to education. In short: How does education improve? How does one define a "contribution" from research? Our reading of government documents and reports on education, the testimony of government officials before Congress, and our discussions with congressional staff and program officials greatly increased our concern with these questions. We finally concluded that the usual evaluation of the impact of fundamental research knowledge on education is far too limited, and deserved our primary attention.

Education is a human service, a massive one. It does not change by leaps and bounds, and even when changes are introduced by design, as in a new curriculum, one finds upon analysis that adaptation to the novelty takes place through a slow, complex, political process. Since clearly defined improvements in education are rare, it is also rare to find a direct and simple movement from fundamental research knowledge to educational practice. And yet anyone familiar with schools, school management, teacher training, and parent-school relationships knows of the movements that have taken place from disciplinary knowledge to public discussion, curricula, and teacher beliefs, which ultimately define practice in education. We found that many reports, program guidelines, and budget documents reflect a far more limited perspective. Presumed in these written materials and the words of many government officials who spoke with us was the conviction that there must be identifiable change that clearly results from a well-defined, once-articulated set of ideas.

We therefore undertook to examine a subtler and deeper vein of transmission from knowledge to education. We believe that educational change is slower, more subtle, and more complex than that usually envisioned, and that one of the most important influences that fundamental research has on education comes through diffusion rather than dissemination. Our conception of this diffusion process is discussed in Chapter 2.

The consensus we reached as a committee on the contribution of basic research to education had considerable impact on a subsequent decision to restate the first question directed to us as: How does fundamental research contribute to education? It was our judgment that ideas from basic research flow gradually, and in complex ways, to the educational community, citizens, parents, and students. These ideas affect not simply educational techniques but the way people think about education, the criticisms and enthusiasms they have regarding it, and the aspirations they hold for themselves and others. Some of this influence can be foreseen, roughly, in fundamental research as it progresses, but much of it cannot. We therefore felt it inappropriate to rank specific lines of research that might make a contribution to education. Instead, we attempted to delineate, by example, fundamental inquiry that has potential usefulness for education. We wished, through these examples, to illustrate the variety of methods that can be used to address topics and problems relevant to education--the process of building the scientific foundation of education--and to demonstrate the potential of contemporary basic research. These examples are found in Chapter 3.

We had also a more general task of evaluating the range of basic research and the health of work relevant to education. The earlier work of individuals and groups aided in this task. One of the most thoughtful volumes we read was *Research for Tomorrow's Schools*, edited by Cronbach and Suppes. We also read a large number of papers written by working groups of researchers who had been sponsored by the NIE. Reports by distinguished groups identified interesting and promising lines of reserach in neuropsychology, information processing, cognitive development, social development, linquistics, sociology, anthropology, and various kinds of learning difficulties. We discovered, in addition, a large number of literature reviews in the various disciplines that identified important problems on which excellent research was being conducted. Finally, we considered a series of other reports, some sponsored by the National Research Council, that evaluated and listed promising lines of research. (These sources are listed in the bibliography.) Once we were fully aware of all this previous work, we concluded that the question of what research, in particular, might be usefully supported had already been adequately answered, at least for the time being. Promising topics for fundamental research have been laid down, if not to the complete satisfaction of all the Committee members, then in abundance and with sufficient regard for quality and promise. Furthermore, we think that identification of promising research must, as a general practice, be based upon the implicit guidance that derives from the system of peer review.

The second and third questions directed to the Committee by the Director of the NIE concerned federal policy, which we were to evaluate and about which we were to formulate recommendations. In this effort we were guided by two assumptions based upon training and experience. First, research is only so "relevant" as its quality allows. If research is not of high quality, no amount of apparent pertinence to important educational issues in its content, method, or site of study will make it relevant. Therefore, research policy must enable the research environment to promote quality in the work of researchers whose support derives from the federal government. Second, today's research cannot be conducted, on the whole, without financial support from the federal government. The problems are far too complex and numerous, the facilities required are too expensive, and the training needs are too sophisticated. Thus, we examined research policy with attention to the adequacy of funding as well as to the quality it encouraged.

Our evaluation of research policy, described in Chapter 4, provoked much discussion and resulted in the recommendations ending the report. We hope these recommendations communicate our continuing belief that the federal government can and should support the growth of knowledge about education that we need to alleviate its problems, to build upon its strengths, and to shape it for the benefit of future generations.

CONCLUSIONS AND RECOMMENDATIONS OF THE COMMITTEE

In this report, the Committee on Fundamental Research Relevant to Education has set forth its views of the contribution that fundamental research can and has made to education. That is, fundamental research has had its major and most useful impact on education through the gradual, public diffusion of new ideas and concepts that have been assimilated into the expectations, practices, and resources of education. These have influenced practitioners' views of reality, their vision of the achievable, their know-how, and their commitment to act (Chapter 2). We have described briefly by example the kinds and variety of fundamental inquiry that we believe may make such a contribution in the future (Chapter 3). We have noted that federal policy in practice does not emphasize fundamental research (Chapter 4). Our recommendations are made with the hope that the federal government will reorient operating policy in education toward fundamental research on how people learn and mature, their diverse sources and settings for learning, and the function and value of what they learn as well as toward improving the quality of all efforts to improve or alleviate problems in education.

A Reemphasis on Fundamental Research

1. Federal policy to build the scientific foundation of education through fundamental research is established in law, precedent, and concept. Nevertheless, basic research on the processes of education is today assigned very low priority in federal agencies charged with the management of educational research and development. In federal agencies, generally, basic research receives about 11 or 12 percent of all funds for R&D; in education, basic research is allocated only 4 percent. In the two agencies primarily concerned with public education in this country--the Office of Education and the National Institute of Education--basic research receives less than 2 percent of the research and development monies. *We recommend an increase in the proportion of the federal investment in education research and development designated for fundamental research* (p. 66).

Improving Scientific Quality of Research and Development

2. Government agencies have swung toward premature attempts to provide quick solutions to educational problems, many of which are not well understood. It is our conclusion that without the guidance of understanding, these practices regularly lead to projects that are of neither practical nor scientific value. *We recommend a change in policy toward more careful assessment of what is known and what must be learned when solution-oriented programs are undertaken* (p. 66).

3. Agencies concerned with educational research are properly concerned with setting research priorities and objectives. But too often the felt significance of an educational problem has been the overwhelming factor in allocating research effort, with insufficient regard for the scientific feasibility of the proposed research. *We recommend that more active investigators be included in the planning and program review of all basic and applied research efforts in education* (pp. 67, 68).

Better Management of Fundamental Research

4. Management practices that have proved appropriate for developing new curricula and moving technical advances into the educational system have not been particularly appropriate for strengthening basic scientific research. *We recommend more extensive use of field-initiated and peer-reviewed systems of research funding* (pp. 69, 70).

5. For some of their programs, the National Institute of Education and other agencies use a single review panel designed to serve different objectives, such as to improve scientific understanding, to encourage materials development, and to devise applications. This practice leads to overload, watered-down concentrations of competence, and a tendency for the more applied and immediate problems to preempt totally the resources available. *We recommend that within each major program (such as Basic Skills in the National Institute of Education or the Office for Handicapped in the Office of Education), separate budgets and review panels be established for field-initiated research. Review panels should be staffed predominantly by currently active basic researchers, with appropriate representation of those more oriented to development and application* (pp. 70, 71, 76).

A More Active Role for the National Institute of Education

6. The National Institute of Education has not made significant progress toward fulfilling its mandate to strengthen the scientific and technological foundations of education. *We recommend that the National Institute of Education take immediate steps to implement a policy of strong support for fundamental research relevant to education* (p. 75).

7. The National Institute of Education should offer leadership in fundamental and applied research relevant to education. *We recommend that*

the Institute redefine its role and implement policies to attract and maintain research of high quality in the field of education, to provide long-term support for work on important problems of education that affect broad sectors of society, and to encourage pioneering applied and fundamental research (p. 75).

8. The National Institute of Education now limits itself almost exclusively to education in public schools. *We recommend that its mission be broadened to include sponsorship of fundamental research on learning throughout life and in the many settings in which education occurs* (pp. 75, 76).

9. The staff of the National Institute of Education must be well informed about research. *We recommend that the National Institute of Education adopt personnel policies that will facilitate the staff's knowledge of research and of programs for research* (p. 71, 72).

National Science Foundation Participation

10. The Science Education Directorate of the National Science Foundation is now planning its first deliberate program of support for research on science education. *The National Science Foundation should establish a strong program of support for fundamental research related to science education* (p. 75).

APPENDIX C

A third appendix included here is a report by the National Council on Educational Research on Fundamental Research Relevant to Education.

NATIONAL COUNCIL ON EDUCATIONAL RESEARCH

NCER Program Committee Report and Draft Policy Resolution

on

Fundamental Research Relevant to Education

The National Institute of Education was established in 1972 in order to increase the effectiveness of educational research and development under the policy of the United States to provide for all persons opportunity to receive an education of high quality. Congress recognized the relationship between quality of education and research of a fundamental nature in the following statement (in the General Education Provisions Act of 1972):

> "To achieve quality will require far more dependable knowledge about the process of learning and education than now exists or can be expected from present research and experimentation in this field. While the direction of the education system remains primarily the responsibility of state and local governments, the Federal Government has a clear responsibility to provide leadership in the conduct and support of scientific inquiry into the educational process."

The Institute was given full responsibility under the Act of 1972: "1.) To help solve or alleviate the problems of, and to promote the reform and renewal of American Education; 2.) to help advance the practice of education, as an art, science, and profession; 3.) to strengthen the scientific and technological foundations of education; 4.) to build an effective educational research and development system." Scientific inquiry into the educational process, or research of a fundamental nature, is essential in carrying out each of these responsibilities, and pursuit of the third depends almost entirely on this kind of research.

The Council requested the Director to contract with the National Academy of Sciences, in cooperation with the National Academy of Education, for a study of fundamental research relevant to education. To paraphrase the Academy report Fundamental Research and the Process of Education fundamental research in education is disciplined inquiry whose purpose is to understand why and how education takes place. These processes are the subject matter of the behavioral and social sciences, such as economics, sociology, political science, psychology, and anthropology, and some of the humanities, such as philosophy and history. The relevance of fundamental research to education derives from the insights it provides into learning, wherever it occurs, and into schooling, that aspect of learning which is more formally organized. We see the Committee's formulation as quite consistent with the definitions used by the National Science Foundation:

> "In basic research the investigator is concerned primarily with gaining a fuller knowledge or understanding of the subject under study."
>
> "In applied research the investigator is primarily interested in a practical use of the knowledge or understanding for the purpose of a recognized need."

The Academy has concluded that "basic research on the processes of education is today assigned very low priority in Federal agencies charged with the management of educational research and development," and that as this applies to the National Institute of Education, the Institute "has not made significant progress toward fulfilling its mandate to strengthen the scientific and technological foundations of education." The Report suggests that serious problems may flow from this situation.

If the knowledge upon which applied research and development projects are based is inadequate, the likelihood of their producing valid or beneficial results is doubtful. Although the Committee is aware of recent progress in NIE support for fundamental research, it believes that even more must be done. If fundamental research is neglected, the program of the Institute becomes less effective.

A major part of the Institute's support should continue to be for projects that have a direct benefit for educational practice and for research of an applied rather than a fundamental nature, including problem-solving, development, and dissemination. A considerable body of fundamental knowledge already exists upon which to base this kind of research. Nevertheless, we are concerned that the knowledge base that already exists should also be extended in order to continue to make application and development possible.

We have consulted with a number of scientists and educators, both about the National Academy's Report and about their own views of the need for fundamental research in education. As a result of these consultations, the Academy Report, and our own deliberations over a period of several months, we are convinced that the situation described is serious, that its implications for the future are even more serious, and that NIE support of fundamental research relevant to education should be increased substantially if the Institute is to fulfill its potential for aiding major long term improvement in education. The following policy is therefore proposed.

I. Allocation of Funds*

A. At least 20% of the Institute's funds shall be used to support fundamental research relevant to education by FY 1979, and by FY 1985 this shall have increased to at least 30%.

B. At least half of the minimum thus allocated (10% of the Institute's funds in FY 1979, increasing to 15% by FY 1985) shall be used for research grants to individual investigators or small groups of investigators.

II. Research Community Involvement:

A. The major purpose of research supported under this policy shall be to extend the knowledge gained through previous or current research or to explore areas where knowledge is lacking and for which a need is evident. Since those who are most familiar with such areas of research are investigators in the field, the Institute shall, to the maximum extent possible, rely upon their assistance in identifying research needs and research to be supported. This assistance should include, but not be limited to, submission of unsolicited proposals, participation in developing guidelines, and review of proposals by groups of highly capable investigators (with multi-disciplinary and cross-disciplinary membership), including investigators close to educational practice.

---

*In preliminary discussion by the Council some members, while supporting fully the intent of the Committee's recommendations, preferred the following wording of Section I:

A. A significantly greater portion of the Institute's budget shall be used for fundamental research in FY 1979 than in FY 1978 and each year thereafter until a level is reached that is satisfactory to both the Director and the Council.

B. At least half of the funds thus allocated shall be used for research grants to individual investigators or small groups of investigators.

B. As part of the continuing external review of NIE, the scientific quality and balance of fundamental research programs shall be evaluated regularly by outside investigators.

C. The Director shall seek to work with all major research associations and organizations whose members may be engaged in fundamental research related to education to accumulate knowledge about such research and to coordinate the Institute's support program with such research.

III. Coordination:

The Director shall seek through the Federal Council on Educational Research and Development and other means to coordinate fundamental research supported by the Federal agencies, to identify areas of fundamental research which should have greater support by NIE or another Federal agency, and to stimulate fundamental research in such areas.

IV. Staff Responsibility For Fundamental Research:

The Director shall insure that within each Program Group there is a substantial number and proportion of staff members who have competence and recent experience in fundamental research, and that these researchers shall be involved in positions of responsibility in all activities of the Program Groups affecting fundamental research decisions.

V. Reports:

Initial plans for implementation of this policy shall be conveyed to the Council within 30 days of its adoption, including resources, allocations and management strategies. Similarly, by January 1, 1978, the Director shall present to the Council for its concurrence a general plan for implementation of this policy through 1985.

The Director shall include in each annual report to the Council a review of the Institute's fundamental research work and efforts to improve it, and shall present to the Council as part of the budget planning process an analysis of options for support of fundamental research under this policy.